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BAY OF BENGAL PILOT.

FOURTH EDITION,

1910.

CAUTION WHEN APPROACHING BRITISH PORTS.

(To be inserted inside cover of all Sailing Directions.)

PART I.—CLOSING OF PORTS.

(1) My Lords Commissioners of the Admiralty having taken into consideration the fact that it may be necessary to forbid all entrance to certain ports of the Empire, this is to give Notice that on approaching the shores of the United Kingdom, or any port of the British Empire, a sharp lookout should be kept for the signals described in the following paragraph, and for the vessels mentioned in paragraph (4), Part II., of this Notice, and the distinguishing and other signals made by them. In the event of such signals being displayed, the port should be approached with great caution, as it may be apprehended that obstructions may exist.

(2) If entrance to a port is prohibited, three *red* vertical lights by night, or three *red* vertical balls by day, will be exhibited in some conspicuous position in or near to its approach, which signals will also be shown by the vessels indicated in paragraph (4), Part II., of this Notice.

If these signals are displayed, vessels must either proceed to the position marked "Examination Anchorage" on the Admiralty Charts and anchor there, or keep the sea.

PART II.—EXAMINATION SERVICE.

(3) Under certain circumstances, it may become necessary to take special measures to examine vessels desiring to enter the ports or localities at home or abroad, referred to in Notices to Mariners No. 1 of 1916 and subsequent years.

(4) In such case, vessels carrying the distinguishing flags or lights mentioned in paragraph (6) will be charged with the duty of examining ships which desire to enter the ports and of allotting positions in which they shall anchor. If Government vessels, or vessels belonging to the local port authority, are found patrolling in the offing, merchant vessels are advised to communicate with such vessels with a view to obtaining information as to the course on which they should approach the Examination Anchorage. Such communication will not be necessary in cases where the pilot on board has already received this information from the local authorities.

(5) As the institution of the Examination Service at any port will never be publicly advertised, especial care should be taken in approaching the ports, by day or night, to keep a sharp lookout for any vessel carrying the flags or lights mentioned in paragraph (6), and to be ready to "bring to" at once when hailed by her or warned by the firing of a gun or sound rocket.

In entering by night serious delay and risk will be avoided if four efficient all round lamps, two *red* and two *white*, are kept available for use.

(6) By day the distinguishing flags of the Examination Steamer will be a special flag (white and red horizontal surrounded by a blue border) and a blue ensign.

Also, three *red* vertical balls if the port is closed.

By night the steamer will carry: (*a*) Three *red* vertical lights if the port is closed; (*b*) three *white* vertical lights if the port is open.

The above lights will be carried in addition to the ordinary navigation lights, and will show an unbroken light around the horizon.

(7) Masters are warned that, when approaching a British port where the Examination Service is in force, they must have the distinguishing signal of their vessel ready to hoist immediately the Examination Steamer makes the signal.

(8) Masters are warned that, before attempting to enter any of these ports when the Examination Service is in force, they must in their own interests strictly obey all instructions as to entry given to them by the Examination Steamer. In the absence of any instructions from the Examination Steamer they must proceed to the position marked "Examination Anchorage" on the Admiralty Charts, and anchor there, or keep the sea.

Whilst at anchor in the Examination Anchorage, Masters are warned that they must not lower any boats (except to avoid accident), communicate with the shore, work cables, move the ship, or permit anyone to leave the ship, without permission from the Examination Steamer.

(9) In case of fog, Masters of vessels are enjoined to use the utmost care, and the Examination Anchorage itself should be approached with caution.

(10) Merchant vessels when approaching British ports are specially cautioned against making use of private signals of any description, either by day or night, the use of them will render a vessel liable to be fired on.

(11) The pilots attached to the ports will be acquainted with the regulations to be followed.

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NOTICE.

HYDROGRAPHIC DEPARTMENT, ADMIRALTY.

In January of each year the information affecting this book, which has been published during the preceding year in the Admiralty Notices to Mariners, is compiled and issued as a separate publication. If a Supplement has been issued during the year, this publication will only include Notices issued since the date of the Supplement. Mariners are advised to procure copies of these publications. They can be obtained gratuitously from the Admiralty Agent or Sub-Agents for the sale of charts on presentation of the coupons on the next page, either personally or by letter. In the latter case the cost of postage must be enclosed.

The Supplements to this book which may be published can also be obtained in a similar manner on presentation of the coupons below.

H. E. P.-C.

Revised Supplement (2) to

Bay of Bengal Pilot,

1910.

Revised Supplement to

Bay of Bengal Pilot,

1910.

Supplement to

Bay of Bengal Pilot,

1910.

(10104) Wt. 39908/430 (3). 2,500.—2/15. T.G.E.

Summary of Notices to Mariners published during 1919, affecting

BAY OF BENGAL PILOT,

1910.

Summary of Notices to Mariners published during 1918, affecting

BAY OF BENGAL PILOT,

1910.

Summary of Notices to Mariners published during 1917, affecting

BAY OF BENGAL PILOT,

1910.

Summary of Notices to Mariners published during 1916, affecting

BAY OF BENGAL PILOT,

1910.

Summary of Notices to Mariners published during 1915, affecting

BAY OF BENGAL PILOT,

1910.

Summary of Notices to Mariners published during 1914, affecting

BAY OF BENGAL PILOT,

1910.

Summary of Notices to Mariners published during 1913, affecting

BAY OF BENGAL PILOT,

1910.

Summary of Notices to Mariners published during 1912, affecting

BAY OF BENGAL PILOT,

1910.

Summary of Notices to Mariners published during 1911, affecting

BAY OF BENGAL PILOT,

1910.

Summary of Notices to Mariners published during 1910, affecting

BAY OF BENGAL PILOT,

1910.

THE

BAY OF BENGAL PILOT,

OR

SAILING DIRECTIONS

FOR THE

COASTS OF CEYLON, INDIA, AND SIAM, FROM COLOMBO TO SALANG ISLAND; WITH THE NICOBAR AND ANDAMAN ISLANDS.

COMPILED FROM VARIOUS AUTHORITIES.

FOURTH EDITION.

PUBLISHED BY ORDER OF THE LORDS COMMISSIONERS OF THE ADMIRALTY.

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ADVERTISEMENT.

The Bay of Bengal Pilot contains sailing directions for the Bay of Bengal, and the coasts of Ceylon, India, and Siam, commencing at Colombo, on the west, and ending at Salang island, on the east, also for the Nicobar and Andaman islands.

The information, which is chiefly derived from surveys conducted by Officers of the Indian Navy, prior to 1863, and by Officers of the Marine Survey of India, since 1874, has been considerably added to from surveys of the west, south, and east coasts of Ceylon, from Colombo to the Little Basses, by Commanders Boyle T. Somerville and Bishop O. M. Davy, R.N., in H.M. surveying vessel *Sealark;* also of portions of the coasts of Burma from a survey, in progress, by the officers of the Marine Survey of India.

The first edition of the Bay of Bengal Pilot, compiled by Commander L. S. Dawson, R.N., was prepared for the press by Lieutenant W. S. White, R.N.; the second edition by Staff-Commander W. N. Goalen, R.N., was published in 1892; the third edition by Commander H. S. Penn, R.N., published in 1901; and the present edition by Staff-Commander J. R. H. MacFarlane, R.N., in addition to the above mentioned, contains all the latest information in the Hydrographic Department of the Admiralty.

As a large extent of the coasts and many of the islands on the eastern side of the bay still remain imperfectly known, it is necessarily incomplete, and seamen are therefore invited to transmit to the Secretary of the Admiralty notices of any errors, or omissions, they may discover, or any additional information they may obtain.

By the publication of this work, the 3rd edition of the Bay of Bengal Pilot, Revised Supplement, 1908, and all Notices to Mariners relating to that work up to and including No. 1,280 of 1910, are cancelled.

H. E. P.-C.

Hydrographic Office,
Admiralty, London,
30th September, 1910.

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GLOSSARY OF A FEW TERMS WHICH MAY BE FOUND USEFUL.

Numerous languages and dialects are used on the various coasts described in the Bay of Bengal Pilot. The language on the south-west and south coasts of Ceylon is Sinhalese; that on the north and east coasts of the same island, Tamil. On the shores of Palk bay the language is Tamil or Malayalam; this gives way to Telugu, north of Madras, Oriya, north of Puri, and Bengali from the Húgli river to the Burmese frontier. Hindustani is, however, very generally used on the east coast of India. On the Eastern side of the Bay of Bengal Arakanese, Burmese, and further southward, Malay, are spoken. The natives of the Nicobar islands use different dialects at the various islands of the group, none of which have been written, but that of Car Nicobar is best known; in the Andaman islands, also, the dialects are many.

English.	Sinhalese.*	Tamil.	Hindustáni.	Bengali.	Burmese.	Malay.
Anchorage	Neva, or Navatwana tena	—	Langar-wara	—	—	—
Bay	Bókka	Kuda	Kol	—	—	Telok.
Boat	Bóttuwa, Oruwa	Toni vallam kattai	Baghla	—	—	Jalur, proa.
Boundary	Máyime, Símáwa	—	—	—	—	—
Canoe (outrigger)	Padawwa, Pádé	—	—	—	—	—
Captain	Kappitta	—	Nakhuda	—	—	—
Cargo	Petawili	Châmàn	Bharti	—	—	—
Coast	Werala	—	Kinara	—	—	—
Cocoa nut	Pólgaha	—	—	—	—	—
,, ,, young	Kurumba	—	—	—	—	—
Communication	—	—	—	—	Galit	—
Creek	—	—	Nadi, nullah	Khal	Chaung	Jurang, churang.
Custom house	Riguwa	Paku, aluppanti	Chauki	—	—	—
Dangerous for boats	Oruwalata amáru	—	—	—	—	—
District	Paláta	—	—	—	—	—
Doctor	—	Dakuttai	Hakim	Vaid, braidya	—	—
European man	Yurópákérayá	—	—	—	—	—
Fine weather	Kadima irtúwa	—	Khula-din	—	—	—
Fish	Málu	—	Machhli	—	—	—
Fisherman	Málu allana miniha	—	Machhwa	—	—	—
Flagstaff	Kodi gaha	Kodi maram	—	—	—	—
Flat country	Samatalá rata	—	—	—	—	—
Food	Méma	—	Khana	—	—	—
Garden or plantation	Watta	—	—	—	—	—
Harbour	Waráya	Turai muka	Bandar	—	—	Labuan.
Hill	Hela	—	—	—	—	—
House	Gé	Védu	—	—	—	Gadong.
Hut	Pela	Kudil	—	—	—	—
Island	—	—	Jingira, dip, lanka	—	Gynn	Pulau, pulo, goh, koh.
Jungle	Kélê	Kàdu	—	—	—	—

---

* The accent over the vowels in Sinhalese indicates that they are *long*, have the broad Continental sound, and should be accentuated. The vowels have otherwise the *short* sound, and all the syllables forming a word have an equal stress.

GLOSSARY OF A FEW TERMS WHICH MAY BE FOUND USEFUL—*continued.*

English.	Sinhalese.*	Tamil.	Hindustáni.	Bengali.	Burmese.	Malay.
Lagoon, fresh water	**Miridiya kalapuwa**	—	—	—	—	—
,, salt water	**Karadiya kalapuwa**	—	—	—	—	—
Lake	**Wila, Wewa**	—	**Jhil**	—	**In**	**Danau, tasik.**
Land	**Goda**	—	**Zamin**	—	—	—
Landing place for canoes	**Totupala**	—	—	—	—	—
Land wind	**Goda-hulan**	—	—	—	—	—
Man of war	**Yuddha newa**	—	—	—	—	—
Market town	—	—	—	**Ganj**	—	**Pakau, pasar.**
Mountain	**Kanda**	**Malai**	**Giri, pahár (par), koh**	—	**Taung**	**Gunong, gle.**
Mountainous country	**Kanda kara rata**	—	—	—	—	—
Mouth of river	**Modara, tota, taru**	**Mukattuvaram**	—	—	—	**Kwala, kuala.**
No	**Nehe**	—	**Nahin**	—	—	—
North wind	**Uturu hulan**	—	—	—	—	—
North-east monsoon	**Isana irtu hulanga**	—	—	—	—	—
Oar	**Habala**	—	**Dand**	—	—	—
Opening	—	—	—	—	**Wa**	**Lapong.**
Pagoda	—	—	—	—	**Kyaung**	—
Pilot	**Pilèttuwá**	—	**Manjhi**	—	—	—
Point of land	**Désatuduwa**	**Munai**	**Karú**	—	—	**Ujong, tanjong.**
Provisions	**Ahara**	**Jin chàmàn**	**Khana**	—	—	—
Rain	**Wessa**	—	**Mehh**	—	—	—
Reef, coral	**Koral para**	—	—	—	—	—
,, rocky	**Gal para**	—	—	—	—	—
Rice (cooked)	**Bat**	—	**Bhat**	—	—	—
River	**Ganga, oya**	**Aru, ar**	**Kári, Nadi, Ganga**	—	**Myit**	**Batang, sungi.**
River mouth	**Gan móya; Módara**	—	—	—	—	—
Road	**Pára**	—	**Rasta**	—	—	—
Rock	**Parvata**	**Kallú, kal**	**Chatan**	—	—	**Batu, trumbu.**
Rocky bay	—	**Kal kudá**	—	—	—	—
Rocky point	—	**Kal munai**	—	—	—	—
Sail	**Ruwala**	—	**Pal**	—	—	—
,, to	**Yatrá karuawá, or Yanawá**	—	**Chama-**	—	—	—
Sailor	**Návikayá; Selaruwa**	—	**Khalasi**	—	—	—
Sand bank	—	—	**Balu danda**	**Char**	—	**Beting.**
Sandy beach	**Well kanda**	—	—	—	—	—
Sea	**Muhuda**	—	**Kala pani**	—	—	—
,, calm	**Niochala muhuda**	—	—	—	—	—
,, breeze	**Mutu hulan**	—	—	—	—	—
,, shore	**Werala**	**Kadat karal**	**Kinara**	—	—	—

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* See note on page viii.

GLOSSARY OF A FEW TERMS WHICH MAY BE FOUND USEFUL—*continued.*

English.	Sinhalese.*	Tamil.	Hindustáni.	Bengali.	Burmese.	Malay.
Small	——	——	Chota	——	Nge	Kechil.
Soldier	Soldáduwá	——	Sipahi	——	——	——
South-west monsoon	Nirita irtu hulanga	——	——	——	——	——
South wind	Dakunu hulan	——	Dakhana	——	——	——
Steamer	Dumnewa	——	——	——	——	——
Stone	Gala	——	——	——	——	——
Surf	Rela, ratè	Alai, kaddal	——	——	——	——
Swell, heavy	Usrala geluma	——	——	——	——	——
Tea plantation	Té watta	——	——	——	——	——
Town	Nuwara; Nagaraya	——	Bara gam	——	Myo, daung	Negri, kedei.
Tree	Gaha, ruka	Maram	——	——	——	——
Valley	Mitiyá wata	——	——	——	——	——
Village, large	Lokugama	——	Chota gam	——	Yua	Kampong.
,, path	Gam maga, or Aturu para	——	——	——	——	——
,, small	Kudágama	——	——	——	——	——
Water, drinking	Bona watura	——	Pand	——	——	——
Wind	Hulanga	Kattu	Pawan	——	——	——
Yes	Ow, or (polite) Eheyi	——	Han, hai	——	——	——

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* See note on page viii.

THE COMPASS.

English.	Hindustáni.	Bengali.	Burmese.	Malay.
North	Gí	Uttá	Miauk	Útára.
N. by E.	Gí wíjau choki	Uttá ek nishan kona	——	——
N.N.E.	Gí wíjau tír	Uttá do nishan kona	——	Útára sa-máta timor.
N.E. by N.	Gí wíjau tír wíjau choki	Uttá tín nishan kona	——	——
N.E.	Gí wíjau arkrop	Nishan kona	Ashi Miauk	Timorlaut or utára Timor.
N.E. by E.	Gí wíjau arkrop wíjau choki	Mutlu tín nishan kona	——	——
E.N.E.	Mutli dau tír	Mutlu do nishan kona	——	Timor sa-máta útára.
E. by N.	Mutli dau choki	Mutlu ek nishan kona	——	——
East	Mutli	Púrub mutlu	Ashi	Timor or timor tapat.
E. by S.	Mutli wíjau choki	Mutlu ek súlí mutlu	——	——
E.S.E.	Mutli wíjau tír	Mutlu do súli mutlu	——	Timor tangára or menoungára.
S.E. by E.	Súli dau arkrop dau choki	Mutlu tín súli mutlu	——	——
S.E.	Súli dau arkrop	Sulí mutlu	Ashi-Taung	Tangára or menoungára.
S.E. by S.	Súli dau arkrop wíjau choki	Sulí tín sulí mutlu	——	——
S.S.E.	Súli dau tír	Sulí do sulí mutlu	——	Salátan menoungára.
S. by E.	Súli dau choki	Súlí ek sulí mutlu	——	——
South	Súli	Súlí	Taung	Salátan.
S. by W.	Súli wíjau choki	Súlí ek sulí kiblu	——	——
S.S.W.	Súli wíjau tír	Súlí do sulí kiblu	——	Salátan dáya.
S.W. by S.	Súli wíjau arkrop dau choki	Súlí tín sulí kiblu	——	——
S.W.	Súli wíjau arkrop	Súlí kiblu ukurub	Anaut Taung	Bárat dáya.
S.W. by W.	Súli wíjau arkrop wíjau choki	Kiblu tín súlí kiblu	——	——
W.S.W.	Kabli dau tír	Kiblu do súlí kiblu	——	Bárat sa máta salátan.
W. by S.	Kabli dau chokí	Kiblu ek súlí kiblu	——	——
West	Kabli	Kiblu	Anaut	Bárat or bárat tapat.
W. by N.	Kabli wíjau choki	Kiblu ek agní kona	——	——
W.N.W.	Kabli wíjau tir	Kiblu do agní kona	——	Bárat sa-máta útára.
N.W. by W.	Gí dau arkrop dau choki	Kiblu tín agní kona	——	——
N.W.	Gí dau arkrop	Agní kona	Anaut Miauk	Bárat laut.
N.W. by N.	Gí dau tír dau choki	Uttá tín agní kona	——	——
N.N.W.	Gí dau tír	Uttá do agní kopa	——	Utára bárat laut.
N. by W.	Gí dau choki	Uttá ek agní kona	——	——

MONEY.

CEYLON.—Legal tender currency consists of the British gold sovereign, which, in 1901, was proclaimed to be equivalent to 15 Rupees, the silver rupee being that in use in India.

The following subsidiary coins are only for use in Ceylon :—

Fifty-cent piece, silver = ½ rupee.
Twenty-five-cent piece, silver = ¼ ,,
Ten-cent piece, silver = $\frac{1}{10}$,,
Five-cent piece, nickel bronze.
One-cent piece, copper.

The Government also issue Notes of the value of 100, 50, 10, and 5 rupees.

BRITISH INDIA.—The principal coin in use is the silver rupee, containing 180 grains of fine silver, and 15 grains of alloy ; for some years the rupee fell in value, but subsequently rose, and since 1898 it has been practically stable at 1s. 4d., and in 1899 an Act made the value of the British sovereign 15 rupees.

A lac = 100,000 rupees.
A crore =10,000,000 ,,

The subsidiary coins are :—

Silver.—½, ¼, and ⅓ rupee.
Nickel.—One anna (serrated) = one penny.
Bronze.—Half anna ; one pice (= ¼ anna) ; one pie (= ⅓ pice).

There is also a paper currency, 5, 10, and 50 rupee notes being legal tender everywhere in India proper, but other notes are only tender within the circles of their issue.

SIAM—

25 Santangs = 1 Salung = 4⅝*d.*
4 Salungs = 1 Tical or Bat = 1*s.* 6½*d.*

The coins are :—Gold - 10 ticals.
Silver - Tical ; 2 Salungs ; 1 Salung.
Nickel - 10 Satang ; 5 Satang.
Bronze - 1 Satang.

WEIGHTS AND MEASURES.

CEYLON.—British weights and measures are used.

BRITISH INDIA.—The following are in general use :—

MADRAS.—English measures, and

1 Kole or Guz = 33 inches.
1 Moolum = 19·5 inches.
1 Puddee = 2·8852 pints.
1 Mercal = 2·8852 gallons.
1 Pará = 14·4261 gallons.

1 Tola = 180 gr. Troy.
1 Cutcha Ser = 4320 gr. Troy.
1 Viss = 3·0857 lbs. Av.
1 Maund = 24·6857 lbs. Av.
1 Candy = 493·7142 lbs. Av.

BENGAL—

1 Moot (4 Ungulee) = 3 inches.
1 Háth = 18 inches.
1 Guz = 1 yard.
1 Coss = 2000 yards.
1 Jojun = 8000 yards.
1 Beegah = 1600 sq. yards.
1 Ser = 1·76195 pints.
1 Tola = 180 gr. Troy.
1 Ser (16 Chittaks) = 2·059 lbs. Av.
1 Factory Maund = 74·66 lbs. Av.
1 Bazár Maund = 72·33 lbs. Av.
1 Imperial Maund = 82·287 lbs. Av.
1 Masha (8 Rutti) = 15 gr. Troy.
1 Ser (4 Powá) = 1·961 pints.
1 Maund (40 Ser) = 9·8098 gallons.

BURMA—

1 Pulgat = 1 inch.
1 Taim or Maik (8 Thit) = 5·5 inches.
1 Toung or Saading (4 Taim) = 22 inches.
1 Lan (4 Toung) = 88 inches.
1 Tha (7 Toung) = 154 inches.
1 Okethapah = 85·56 yards.
1 Tain = 1069·44 yards.
1 Dain (4 Tain) = 2·430 miles.
1 Uzena = 15·555 sq. miles.
1 Lamyet = 1 gill.
1 Salay = 1 pint.
1 Sah = 1 gall.
1 Saik = 1 peck.
1 Teng = 1 bushel.
1 Coyan (100 Teng) = 12·5 quarters.
1 Large Ruay = 3·937 gr. Troy.
1 Bai or Anna = 15·75 gr. Troy.
1 Moo = 31·5 gr. Troy.
1 Mat = 63 gr. Troy.
1 Tikal or Kyat = 252 gr. Troy.
1 Viss or Piakthà = 3·6 lbs. Av.

NOTE.—By the Indian Weights and Measures of Capacity Act, 1871, to provide for the ultimate adoption of a uniform system of weights and measures throughout British India, it is enacted that the primary standard of weight shall be called a Ser, and that it shall be equal, when weighed in a vacuum, to the weight known in France as the Kilogramme = 2·20462 lbs. avoirdupois. The units shall be, for weights, the said Ser; for measures of capacity, a measure containing one such Ser of water at its maximum density, weighed in a vacuum.

This Act has never been brought into operation.

SIAM—

1 Niu = 0·83 inch.
1 Keup (12 Niu) = 10 inches.
1 Sok (2 Keup) = 20 inches.
1 Wah (4 Sok) = 80 inches.
1 Sen (20 Wah) = 44·4 yards.
1 Yot (400 Sen) = 9·875 miles.
1 Thang = 3·75 galls.
1 Coyan = 375 galls.
1 Tical = 0·53 oz.
1 Tamlung (4 Ticals) = 2·1 oz.
1 Chang (20 Tamlungs) = 2lbs. 10·3oz.
1 Hap (50 Chang) = 132¼ lbs.

SYSTEM OF ORTHOGRAPHY.

Adopted by the Admiralty for Sailing Directions and Charts.

As far as has been found possible with existing knowledge, native names are spelt in accordance with the following system, which has been adopted by the principal authorities in Great Britain and by the United States, and has been for some years in process of gradual introduction into all Admiralty Sailing Directions and Charts.

No change is made in the orthography of foreign names in countries which use Roman letters; thus French, Spanish, Portuguese, Dutch, &c., names will be spelt as by the respective nations.

1. Where native names have been so long written in a form which, though not in accordance with this system, has become familiar to English eyes from being so spelt in all charts and maps, they are retained.

2. The true sound of the word as locally pronounced is taken as the basis of the spelling.

3. An approximation of the sound is alone aimed at. A system which would attempt to represent the more delicate inflections of sound and accent would be so complicated as only to defeat itself.

4. The broad features of the system adopted are that vowels are pronounced as in Italian and consonants as in English, *every letter being pronounced.* Two accents only are used:—

(1) The acute, to denote the syllable on which stress is laid. The use of this is very important, as the sounds of many names are entirely altered by the misplacement of this "stress."

(2) The sign ˘ over the letter U to denote the short sound of that vowel under certain circumstances. (*See* Table.)

5. When two vowels come together, each one is sounded, though the result, when spoken quickly, is sometimes scarcely to be distinguished from a single sound, as in *ai*, *au*, *ei*.

The amplification of the rules is given below.

Information is invited as to the proper spelling of native names, so as to produce the nearest approximation to the true sound, by this system.

Letters.	Pronunciation and Remarks.	Examples.
a	*ah*, *a* as in *father* - - - - - -	Java, Banána, Somáli, Bari.
e	*eh*, *e* as in *bet*; *a* as in *fate* - - -	Tel-el-Kebír, Oléleh, Yezo, Levúka, Peru.
i	English *e*; *i* as in *ravine*; the sound of *ee* in *beet*. Thus, not *Feejee*, but	Fiji, Hindi.
o	*o* as in *mote* - - - - - - -	Tokyo.
u	long *u* as in *flute*; the sound of *oo* in *boot*. *oo* or *ou* should never be employed for this sound. Thus, not *Zooloo* or *Zoulou*, but	Zulu, Sumatra.

Letters.	Pronunciation and Remarks.	Examples.
	The shorter sound of the different vowels, when necessary to be indicated, can be expressed by doubling the consonant that follows. The sounds referred to are as follows:— The short *a* as in *fatter*, as compared with the long *a* as in *father*. The short *e* as in *better*, as compared with the long *e* as in *me*. The short *i* as in *sinner*, as compared with the long *i* as in *wine*. The short *o* as in *sobbing*, as compared with the long *o* as in *sober*. The short *u* as in *rubber*, as compared with the long *u* as in *rubric*.	Yarra, Tanna, Mecca, Jidda, Bonny.*
ŭ	is the same short sound of *u* as is denoted by doubling the consonant following, but is used, and only used, where such doubling is impossible, as in case of words where *u* is followed by two different consonants, as in *Tŭng*, pronounced as the English *tongue*.	
	Doubling of a vowel is only necessary where there is a distinct repetition of the single sound.	Nuulúa, Oosima.
ai	English *i* as in *ice* - - - -	Shanghai.
au	*ow* as in *how*. Thus, not *Foochow*, but	Fuchau.
ao	is slightly different from *au* - - -	Macao.
aw	when followed by a consonant or at the end of a word as in *law* - - - thus	Cawnpore.
ei	is the sound of the two Italian vowels, but is frequently slurred over, when it is scarcely to be distinguished from *ey* in the English *they*, or *ei* in *eight*.	Beirút, Beilul.
b	English *b*.	
c	is always soft, but is so nearly the sound of *s* that it should be seldom used.	Celébes.
	If *Celébes* were not already recognised it would be written *Selébes*.	
ch	is always soft as in *church* - - -	Chingchin.
d	English *d*.	
f	English *f*. *Ph* should not be used for the sound of *f*. Thus, not *Haiphong*, but	Haifong, Nafa.
g	is always hard. (Soft *g* is given by *j*) -	Galápagos.
h	is always pronounced when used.	
hw	as in *what*, better rendered by *hw* than *wh*, or *h* followed by a vowel. Thus, *Hwang ho*, not *Whang ho* or *Hoang ho*.	Hwang ho, Ngan hwei.
j	English *j*. *Dj* should never be put for this sound.	Japan, Jinchuen.

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* The *y* is retained as a terminal in this word under Rule 1. The word is given as a familiar example of the alteration in sound caused by the second consonant.

Letters.	Pronunciation and Remarks.	Examples.
k	English *k*. It should always be put for the hard *c*. Thus, not *Corea*, but	Korea.
kh	The Oriental guttural - - - -	Khan.
gh	is another guttural, as in the Turkish -	Dagh, Ghazi.
l m n	As in English.	
ng	has two separate sounds, the one hard as in the English word *finger*, the other as in *singer*. As these two sounds are rarely employed in the same locality, no attempt is made to distinguish between them.	
p	As in English.	
ph	As in *loophole* - - - - - -	Mokpho, Chemulpho.
th	stands both for its sound in *thing*, and as in *this*. The former is most common -	Bethlehem.
q	should never be employed; the sound of *qu* in *quiver* is given as *kw*. When *qu* has the sound of *k*, as in *quoit*, it should be given by *k*.	Kwangtung.
r	As in English.	
s	As in *sin*.	
sh t v w x	As in English.	
y	is always a consonant, as in *yard*, and therefore should never be used as a terminal, *i* or *e* being substituted. Thus, not *Mikindány* or *Wady*, but not *Kwaly*, but	Kikũyu. Mikindáni, Wadi. Kwale.
z	English *z* - - - - - - -	Zulu.
zh	French *j*, or as *s* in treasure - - -	Muzhdaha.
	Accents should not generally be used, but where there is a very decided emphatic syllable or stress which affects the sound of the word, it should be marked by an *acute* accent.	Tongatábu, Galápagos, Paláwan, Saráwak.

In the case of native names in countries under the dominion of other European powers, in whose maps, charts, &c., the spelling is given according to the system adopted by that power, such orthography is, as a rule, disregarded, and the names are spelt according to the British system. Thus the island east of Java in possession of the Dutch is spelt Madoera by them, but on Admiralty charts Madura. A town in Java appears on Dutch charts as Tjilatjap; in the British, Chilachap.

The phonetic value of vowels in Oriental languages is given below, but the accents have been omitted to be used in this work.

a	as the	*u*	in	*but.*
ā	,,	*a*	in	*father.*
e	,,	*ai*	in	*fail.*
i	,,	*i*	in	*hit.*
ī	,,	*ee*	in	*cheese.*
o	,,	*o*	in	*bold.*
u	,,	*oo*	in	*wood.*
ū	,,	*oo*	in	*fool.*
ai	,,	*ai*	in	*aisle.*
au	,,	*ou*	in	*loud.*

In other combinations of vowels they should be pronounced separately on the above principles.

When a foreign language is written in a vocabulary of fixed sounds, so as to permit of transliteration into the British system, a table of equivalents for each letter is drawn up, and names of places can be transliterated without regard to pronunciation.

To reduce Greek names to the orthographic form, required by the foregoing system, would require so many changes that it has been decided to defer the revision of Admiralty publications until the system has been more generally introduced and used.

The Greek names are therefore left for the present in their old shape, but these give in most cases a very erroneous idea of the sound of the names, as pronounced by Greeks, and in many cases the modern Greek spelling gives a clue to the pronunciation by aid of the table of equivalents.

Thus	Ευβοια	now spelt	Eubœa	is pronounced	Evvia.
,,	Χαλκις	,,	Chalcis	,,	Khalkis.
,,	Κεφαλληνια	,,	Cephallonia	,,	Kefallinia.

Whenever C appears in a Greek name as at present written it may be taken for granted it has the sound of K.

Greek Letters	Roman Equivalents by Admiralty System	Greek Letters	Roman Equivalents by Admiralty System
Α α	a	Ρ ρ	r
Β β	v	Σ σ ς	s
Γ γ	g	Τ τ	t
Δ δ	d	Υ υ	i
Ε ε	e	Φ φ	ph
Ζ ζ	z	Χ χ	kh
Η η	i	Ψ ψ	ps
Θ θ	th	Ω ω	o
Ι ι	i	ΑΙ αι	ei
Κ κ	k	ΕΙ ει	i
Λ λ	l	ΟΙ οι	i
Μ μ	m	ΟΥ ου	u
Ν ν	n	Υι υι	i
Ξ ξ	x	ΑΥ αυ	aph, av
Ο ο	o	ΕΥ ευ	eph, ev
Π π	p	ΗΥ ηυ	iph, iv

INFORMATION RELATING TO CHARTS, SAILING DIRECTIONS, AND THE GENERAL NAVIGATION OF H.M. SHIPS.

ON THE CORRECTION OF CHARTS, SAILING DIRECTIONS, AND LIGHT LISTS.

The three descriptions of publications as guides to navigation, which are affected by the continual changes and alterations that take place, are the Charts, the Sailing Directions, and the Light Lists.

Of these the Charts should always be, so far as our knowledge permits, absolutely correct to date; the Sailing Directions, however, cannot, from their nature, be so corrected, and *in all cases where they differ from charts, the largest scale chart must be taken as the guide for navigation.*

The Light Lists are corrected annually.

1. *Charts.*—When issued to a ship on commissioning, the charts have received all necessary corrections to date. As sent from the Hydrographic Department they are correct to the date of issue as stamped on each folio. They then receive such corrections by hand in the depôts as are required, and are so issued to the ships.

The charts in the folios should have the same number and title as shown against each in the Lists pasted on the outside of the folio. The Navigating Officer is to satisfy himself that they do so agree before signing the receipt for the charts, &c.

All small but important corrections affecting navigation that can be made by hand are notified by Notices to Mariners, and should at once be placed on the charts to which they refer, in accordance with the following uniform system:—

1. All corrections, additions to, or erasures on charts are to be neatly made in *red* (except as explained later in paragraph 6). In every case the recognised chart abbreviations are to be used.

2. The number and date of every Notice to Mariners, from which corrections, &c., as above have been made, are to be entered at the lower left-hand corner of the chart, in *red*, in the following manner, viz.:—

07 . *123*, *1145*, *1503;* 08 . *232;* 10 . *1506*, *1721;* 11 . *34*, &c.

3. The *amount* of the substance of a Notice to Mariners inserted on the chart should as a general rule be limited to what is likely to be engraved on the chart plate when corrected in office, and it should also be inserted as far as possible in a similar style; thus:—

(*a*) the amount of information to be inserted depends on the scale of the chart, and should be in accordance with that already engraved on the chart. On the largest scales will generally be found all the principal details of lights and their sectors, buoys, &c. On the smallest scales buoys are seldom inserted, and lights are only briefly described as Lt. F., Lt. Gp. Fl., Red, &c., &c., without any details as to height, visibility, periods, &c.;

(*b*) when inserting corrections, care must be taken not to obliterate any of the other information already on the chart;

(*c*) wrecks are shown thus, $\underline{/\ /\ /}$ "Wreck," and on large scales the "year" is added;

(*d*) when "Notes" are to be inserted (such as Cautionary, Tidal, &c.) they should be written in a convenient but conspicuous place, where they will not interfere with any other details.

4. The numbers and dates of Notices should *not* be entered on the Charts, except as required by paragraph 2, as they only tend to the increase of illegibility.

5. Erasures, when necessary, should consist of a single line made with a pen. A knife or ink eraser should not be used.

6. Temporary or intended changes should be inserted on the chart in pencil, and in the latter case finally inked in, in red, when further notice has been received confirming the previous one.

7. One copy of each Notice to Mariners should be pasted into the Sailing Directions in its appropriate place, so that, if fuller detail is required than what the scale of the chart permits to be given, it may be found on the proper page referring to the given locality or subject.

When these corrections are so large that they cannot be conveniently thus made they are put upon the plates, and fresh copies are issued to the ships to replace the others, which are directed to be destroyed to prevent the possibility of their being used in the navigation of the ship.

The dates on which these large corrections are made are noted on the chart plates under the heading of "New Editions" in the middle of the lower edge; those of the smaller corrections at the left-hand lower corners as "Small Corrections."

In all cases of quotations of charts, these dates of corrections should be given, as well as the number of the chart (which will be found in the lower right-hand corner), in order that at the Admiralty it may be known what edition of the chart is referred to, and to what date the chart has been corrected.

It should be remembered that in addition to the large and small corrections here mentioned, the chart plates are being constantly corrected for numerous details not considered to be of such a nature as to affect safe navigation. For these corrections the charts are not necessarily dated, nor are any Notices to Mariners issued, and it follows therefore that two charts, both bearing the same dates of "New Editions" and "Small Corrections," may not exactly agree in all respects.

2. *The Sailing Directions* are not corrected before issue, but on page iii. in the "Advertisement" to each volume will be found the number of the last Notice to Mariners used in its revision, the numbers of the subsequent Notices affecting it between going to press and issue to H.M. Ships are given in the first Notice to Mariners relating to that part of the world after date of publication.

Supplements and Revised Supplements referring to each volume are published from time to time. Supplements contain all the information received up to date since the publication of the volume to which they refer, and a Revised Supplement cancels the previous Supplement.

The existence of a Supplement is to be noted in the tabular form placed for the purpose inside the cover of each volume, and also on receipt of a further Revised Supplement after commission. Two copies are issued to each ship, one to cut up, the slips being pasted in the volume at the appropriate place; the other to retain intact for reference.

In the advertisement to each will be found a similar statement as to the number of the last Notice to Mariners used in its compilation.

In January of each year, a summary of the information affecting each volume of Sailing Directions, which has been published during the preceding year in Notices to Mariners, is issued in a separate publication (commencing January, 1908). If a Supplement or Revised Supplement has been issued during the year, this summary will only include Notices to Mariners issued since the date of such Supplement; if one is in preparation at the end of the year, no summary will be issued. These summaries are only issued to H.M. Ships with the books to which they refer.

An early duty of the Navigating Officer after drawing a chart set is to correct the Sailing Directions from the Supplements or Revised Supplements, Annual Summaries of Notices to Mariners and Notices to Mariners supplied with the chart set.

As Notices to Mariners prior to the date of issue of a chart set from the Hydrographic Department are not supplied with the set, he should therefore demand from that Department such Notices to Mariners as are required to complete the interval between the last published Supplement, Revised Supplement, or Summary of Notices to Mariners, and the first number of the Notices to Mariners drawn with the chart set.

One copy of each Notice to Mariners should be pasted into the Sailing Directions in its appropriate place as soon as received.

It must, however, be thoroughly understood that Sailing Directions will never be correct in all minor details, except up to the date of the last Supplement or Revised Supplement, and that, as already stated, when differences exist, the chart, which should be corrected from the most recent information, should be taken as the guide; for which purpose, for ordinary navigation, they are sufficient.

3. *The Light Lists*, annually published at the beginning of each year, are not corrected in the depôts before issue, but appendices are issued every two months, giving the alterations that have taken place, copies of which are put into the chart boxes.

It is the duty of the navigating officer when he receives the set of charts to make notations in the Light Lists from these appendices, and from Notices to Mariners of later date; and to keep them so corrected from time to time.

The Light Lists should always be consulted as to the details of a light, as the description in the Sailing Directions does not embrace the sectors, and the other information on the lights may be obsolete, in consequence of changes made since publication. A red label to this effect is inserted at page 1 of all Sailing Directions. The charts also may not be equally up-to-date in some details, for which no Notices to Mariners have been issued.

THE USE OF CHARTS AS NAVIGATIONAL AIDS AND GENERAL REMARKS RELATING TO PRACTICAL NAVIGATION.

1. *Reliance on a Chart.*—The value of a chart must manifestly depend upon the accuracy of the survey on which it is based, and this becomes more important the larger is the scale of the chart.

To estimate this, the date of the survey, which is always given in the title, is a good guide. Besides the changes that, in waters where sand or mud prevails, may have taken place since the date of the survey, the earlier surveys were mostly made under circumstances that precluded great accuracy of detail, and, until a plan founded on such a survey is tested, it should be regarded with caution. It may, indeed, be said that, except in well-frequented harbours and their approaches, no surveys yet made have been so minute in their examination of the bottom as to make it certain that all dangers have been found. The fullness or scantiness of the soundings is another method of estimating the completeness of a chart. When the soundings are sparse or unevenly distributed, it may be taken for granted that the survey was not in great detail.

It appears to be insufficiently realised that the degree of reliance which may reasonably be placed upon an Admiralty chart, even in surveys of modern date, is mainly dependent on the scale on which the survey was made. The scale for publication is now generally that of the original survey, except in the case of Coast sheets, which are sometimes reduced. It should not, therefore, be assumed that the original survey was made on a larger scale than that published.

It must be borne in mind that the only method of ascertaining the inequality of the bottom of the sea is by the laborious process of sounding, and that in sounding over any area, the boat or vessel obtaining the soundings is kept on given lines; that each time the lead descends it only ascertains the depth of water over an area equal to the diameter of the lead, that is about two inches, and that consequently each line of soundings, though miles in length, is only to be considered as representing a width of two inches.

Surveys are not made on uniform scales, but each survey is made on a scale commensurate with its apparent importance. For instance, a general survey of a coast which vessels only pass in proceeding from one place to another is not usually made on a scale larger than one inch to the nautical mile, while surveys of areas where vessels are likely to anchor, are made on a scale of three inches to the mile, and surveys of frequented ports, or harbours likely to be used by Fleets, on a scale of from six inches to ten inches to the nautical mile.

Close examination by sounding is the only method by which surveys on a large scale can be made, and in view of the vast mileage of surveys yet requiring completion in the interests of navigation, it would be a waste of time to undertake large scale Coast surveys.

The scale on which a survey is to be conducted having been settled, it is manifestly superfluous to obtain more lines of soundings than can be represented on the paper. 100 soundings, which is the maximum number that can be placed with clearness on every square inch of paper, means that on a scale of one inch to the mile each sounding on the chart occupies an area representing eight acres of actual ground, whilst on a scale of six inches to the mile each sounding represents an area of a little less than a quarter of an acre, *i.e.*, of 100 feet square.

The following diagram represents as many soundings as can be placed legibly on a square inch of paper:—

16	15	15	13	13	14	12	11	10	9
14	15	14	14	13	13	12	11	9	8
15	15	14	17	16	14	13	10	10	9
16	16	17	18	16	12	11	8_5	9	10
18	17	15	12	9	7_5	7_4	7_4	9	10
19	16	12	9	5_5	4_4	5_4	6_4	8_5	9
22	19	16	10	3_4	5_4	6_4	7_4	8_3	10
20	16	12	7_4	5_4	6_4	6_4	7_4	8_5	10
18	15	11	9	7_4	7	7_4	8_4	10	11
20	17	14	11	12	10	9	10	11	13

Little assistance in detecting excrescences on the bottom is afforded by the eye, when sounding in a boat, even in clear weather, on account of the observer being within five feet of the surface: none in turbid seas. If, therefore, there is no inequality in the soundings to cause suspicion, a shoal patch between two lines may occasionally escape detection.

Lines of soundings plotted as close as may be practicable on a scale of 6 inches to the mile would be 100 feet apart, and each line would be only 2 inches in actual width.

Thus, in a chart on a scale of 1 inch to the mile, an inequality of some acres in extent rising close to the surface, if it happened to be situated between two lines, might escape the lead; whilst in a chart on a scale of 6 inches, inequalities as large as battleships, if lying parallel to, and between the lines of soundings, might exist without detection if they rose abruptly from an otherwise even bottom.

General Coast charts should not, therefore, be looked upon as infallible, and a rocky shore should on no account be approached within the contour line of 10 fathoms, without taking every precaution to avoid a possible danger; and even with surveys of harbours on a scale of 6 inches to the mile, vessels should avoid, if possible, passing over charted inequalities in the ground, as some isolated rocks are so sharp that the lead will not rest on them.

Blank spaces among soundings mean that no soundings have been obtained in these spots. When the surrounding soundings are deep it may with fairness be assumed that in the blanks the water is also deep; but when they are shallow, or it can be seen from the rest of the chart that reefs or banks are present, such blanks should be regarded with suspicion. This is especially the case in coral regions and off rocky coasts, and it should be remembered that in waters where rocks abound it is always possible that a survey, however complete and detailed, may have failed to find every small patch.

A wide berth should therefore be given to every rocky shore or patch, **and this rule should be invariably followed, viz., that instead of considering a coast to be clear unless it is shown to be foul, the contrary should be assumed.**

2. *Fathom Lines a Caution.*—Except in plans of harbours that have been surveyed in detail, the five-fathom line on most Admiralty charts is to be considered as a caution or danger line against unnecessarily approaching the shore or bank within that line, on account of the possibility of the existence of undiscovered inequalities of the bottom, which nothing but an elaborate detailed survey could reveal. In general surveys of coasts or of little frequented anchorages, the necessities of navigation do not demand the great expenditure of time required for such a detailed survey. It is not contemplated that ships will approach the shores in such localities without taking special precautions.

The ten-fathom line is, on rocky shores, as before mentioned, another warning, especially for ships of heavy draught.

Charts where no fathom lines are marked must be especially regarded with caution, as it generally means that soundings were too scanty and the bottom too uneven to enable them to be drawn with accuracy.

Isolated soundings, shoaler than surrounding depths, should always be avoided, especially if ringed round, as there is no knowing how closely the spot may have been examined.

3. *Chart on largest scale always to be used.*—It sometimes happens that, from press of work, only the copper plate of the larger scale chart of a particular locality can at once receive any extensive re-arrangement of coastline or soundings. This is an additional reason, besides the obvious one of the greater detail shown, why this largest scale chart should always be used for navigating.

4. *Caution in using Small Scale Charts.*—In approaching the land or dangerous banks, regard must always be had to the scale of the chart used. A small error in laying down a position means only yards on a large scale chart, whereas on a small scale the same amount of displacement means large fractions of a mile. This is particularly to be observed when coming to an anchor on a narrow ledge of convenient depth at some distance from the shore.

For the same reason bearings to objects near should be used in preference to objects farther off, although the latter may be more prominent, as a small error in bearing or in laying it down on the chart has a greater effect in misplacing the position the longer the line to be drawn.

5. *Graduation.*—All Plans are now being graduated in skeleton style before publication in order to facilitate easy reference to Astronomical positions; previously published plans are also graduated as opportunity offers. The graduation is, however, of necessity, often based upon imperfect information of a conflicting nature; for this reason, whenever an Astronomical position is quoted other than approximate (*i.e.*, when seconds are given), it is necessary to quote also the number of the particular chart from which the position has been derived.

6. *Distortion of Printed Charts.*—The paper on which charts are printed has to be damped. On drying, distortion takes place from the inequalities in the paper, which greatly varies with different paper and the amount of the original damping; but it does not affect navigation. It must not, however, be expected that accurate series of angles taken to different points will always exactly agree, when carefully plotted upon the chart, especially if the lines are to objects at some distance. The larger the chart the greater the amount of this distortion.

7. *Buoys.*—It is manifestly impossible that any reliance can be placed on buoys always maintaining their exact position. Buoys should therefore be regarded as warnings and not as infallible navigating marks, especially when in exposed positions; and a ship should always, when possible, be navigated by bearings or angles of fixed objects on shore and not by buoys.

Gas Buoys.—The lights shown by gas buoys cannot be implicitly relied on, as, if occulting or flashing, the apparatus may get out of order, or the light may be altogether extinguished. These lights in the British islands are from 5 to 217 candle power.

8. *Lights.*—Circles drawn on charts round a light are not intended to give information as to the distance at which it can be seen, but solely indicate, in the case of lights which do not show the same characteristics or colours in all directions, the bearings between which the differences occur.

All the distances given in the Light Lists and on the charts for the visibility of lights are calculated for a height of an observer's eye of 15 feet. The table of distances visible due to height, at the end of each Light List affords a means of ascertaining how much more or less the light is visible should the height of the bridge be more or less. The glare of a powerful light is often seen far beyond the limit of visibility of the actual rays of the light, but this must not be confounded with the true range. Again, refraction may often cause a light to be seen farther than under ordinary circumstances.

When looking out for a light at night, the fact is often forgotten that from aloft the range of vision is much increased. By noting a star immediately over the light a very correct bearing may be afterwards obtained from the standard compass.

The intrinsic power of a light should always be considered when expecting to make it in thick weather. A weak light is easily obscured by haze, and no dependence can be placed on its being seen.

The power of a light can be estimated by remarking its order, or candle power, as given in the Light Lists, and in some cases by noting how much its visibility in clear weather falls short of the range due to the height at which it is placed. Thus, a light standing 200 feet above the sea, and only recorded as visible at 10 miles in clear weather, is manifestly of little brilliancy, as its height would permit it to be seen over 20 miles, if of any power. (*See* table in Light List before mentioned.)

The distance from a light cannot be estimated either by its brilliancy or its dimness.

On first making a light from the bridge, by at once lowering the eye several feet and noting whether the light is made to dip, it may be determined whether the vessel is in the circle of visibility corresponding with the usual height of the eye or unexpectedly nearer the light.

9. *Fog Signals.*—Sound is conveyed in a very capricious way through the atmosphere. Apart from wind, large areas of silence have been found in different directions and at different distances from the fog signal station, in some instances even when in close proximity to it. The apparatus, moreover, for sounding the signal often requires some time before it is in readiness to act. A fog often creeps imperceptibly towards the land, and is not observed by the people at a station until it is upon them; whereas a ship may have been for many hours in it, and approaching the land. In such a case no signal may be made. When sound has to travel against the wind, it may be thrown upwards; in such a case, a man aloft might hear it when it is inaudible on deck. Under certain conditions of the atmosphere, when a fog signal is a combination of high and low notes, one of the notes may be inaudible.

The mariner should not assume—

a. That, because he fails to hear the sound, he is out of hearing distance.

b. That, because he hears a fog signal faintly, he is at a great distance from it.

c. That, because he hears the sound plainly, he is near it.

d. That, because he does not hear it, even when in close proximity, the fog signal has ceased sounding.

e. That the distance from and the intensity of the sound on any one occasion, are a guide to him for any future occasion.

Taken together, these facts should induce the utmost caution in closing the land in fogs. The lead is generally the only safe guide.

10. *Tides and Tidal Streams.*—In navigating coasts where the tidal range is considerable, caution is always necessary. It should be remembered that there are indraughts to all bays and bights, although the general run of the stream may be parallel to the shore.

The turn of the tidal stream off-shore is seldom coincident with the time of high and low water on the shore. In open channels, the tidal stream ordinarily overruns the turn of the vertical movement of the tide by about three hours, forming what is usually known as tide and half-tide, the effect of which is that at high and low water by the shore the stream is running at its greatest velocity.

In crossing a bar or shallow flats, "Table B, for finding the height of tide at any intermediate hour between high and low water," and diagrams, given in the Tide Tables, will be found of great assistance in calculating how much the water has risen or fallen at any hour of the tide.

On coasts where there is much diurnal inequality in the tides, the amount of rise and fall can never be depended upon, and additional caution is necessary.

It should also be remembered that at times the tide falls below the level of low-water ordinary springs. This always occurs on the coasts of Europe at the equinoxes, but in other parts of the world, and especially in the tropics, such periodic low tides may coincide more frequently with the solstices. Wind or a high barometer may produce it at any time, and the amount varies with locality. When the moon's perigee coincides with the full or new moon the same effect is often produced.

11. *Arrows* on charts only show the most usual or the mean direction of a tidal stream or current. It must never be assumed that the direction of a stream will not vary from that indicated by the arrow. In the same manner, the rate of a stream constantly varies with circumstances, and the rate given on the chart is merely the mean of those found during the survey, possibly from very few observations.

12. *Fixing Position.*—The most accurate method of fixing a position relative to the shore is by angles between well-defined objects on the chart. All ships are supplied with a station-pointer, and this method should be used whenever possible.

Two things are, however, necessary to its successful employment. First, that the objects be well chosen; and, second, that the observer is skilful and rapid in his use of the sextant and station-pointer.

For the former, reference can be made to the pamphlet on the use of the station-pointer, which is in every chart box; the latter is only to be obtained by practice.

It will readily be seen that in war time, when the compass may be knocked away, or gun-fire may make it undesirable to expose the person more than necessary, a sextant offers great advantages, as angles can be obtained from any position whence the objects are visible. It is this contingency that makes it especially desirable that all navigating officers should become expert in this method of fixing a ship's position.

In many narrow waters also, where the objects may yet be at some distance, as in coral harbours or narrow passages among mud banks, navigation by sextant and station-pointer is invaluable, as a true position can only be obtained by its means. A small error in either taking or plotting a bearing under such circumstances may put the ship ashore.

It is not intended that the use of the compass to fix the ship should be given up; there are many circumstances in which it may be usefully employed, but errors more readily creep into a position so fixed. In all cases where great accuracy of position is desired, angles should invariably be used, such as the fixing of a rock or shoal, or of additions to a chart, of fresh soundings or new buildings. In all such cases angles should be taken to several objects, the more the better; but five objects is a good number, as the four angles thus obtained not only prevent any errors, but they at once furnish a means of checking the accuracy of the chart itself. In the case of ordinary soundings, it is only necessary to take a third angle now and then; firstly, to check the general accuracy of the chart as above stated; secondly, to make certain that the more important soundings, as at the end of a line, are correctly placed.

Sometimes, when only two objects are visible, a compass bearing and sextant angle may be used with advantage.

In passing near a point of land, or an island, the method of fixing by doubling the angle on the bow is invaluable. The ordinary form of it, the so-called "four-point bearing," when the bearing is taken four points on the bow and on the beam, the distance from the object at the latter position being the distance run between the times of taking the two bearings, allowing for current, gives an excellent fix for a departure but does not ensure safety, as the point and probably the rocks off it are abeam before the position is obtained.

By taking the bearings of two points and four points on the bow, a very good position is obtained before the object is passed; the distance of the latter at the second position being, as before, equal to the distance run in the interval, allowing for current.

This is, however, only strictly true, if the current is directly with or against the course of the ship. If a cross current has to be allowed for, the results by this method may be altogether erroneous and misleading. The following example shows in a tabular form the errors that might be produced by accepting the distance run in the interval, allowing for current, as the distance of the object at time of second bearing.

Example: A vessel steering East sights a light bearing E.N.E., or two points on the bow; one hour after, having run in the interval 10 miles by log, the light bears N.E., *i.e.*, she has doubled the angle on the bow. Current, in all cases, at the rate of 2 miles an hour.

Direction of Current.	Distance run between 1st & 2nd Bearings.		Distance of Light at 2nd Bearing.	Direction of Current.	Distance run between 1st & 2nd Bearings.		Distance of Light at 2nd Bearing.
	By Log.	Allowing for Current.			By Log.	Allowing for Current.	
	Miles	Miles	Miles		Miles	Miles	Miles
East	10	12	12	West	10	8	8
E.N.E.	10	11·8	10	W.S.W.	10	8·2	10·2
N.E.	10	11·4	8	S.W.	10	8·7	11·9
N.N.E.	10	11	6·2	S.S.W.	10	9·4	13·6
North	10	10·2	5·3	South	10	10·2	14·7
N.N.W.	10	9·4	4·9	S.S.E.	10	11	15
N.W.	10	8·7	5·3	S.E.	10	11·4	14·7
W.N.W.	10	8·2	6·1	E.S.E.	10	11·8	13·8

The following rule should be observed in all cases of a cross current, viz.:—

When the angle between the second bearing and the course made good (over the ground) is double the angle between the first bearing and the course made good (over the ground) the distance from the object is equal to the distance made good (over the ground) between the times of the first and second bearings.

To get a reliable result the difference between the first bearing and the course made good (over the ground) should never be less than 20°. It follows, therefore, that it is necessary, before observing the first bearing, to decide upon the course being made good (over the ground). This may be done as follows, viz.:—

From any point, A, on the chart draw a line A B, representing by its direction the course steered and by its length the speed through the water. From the point B, draw another line, B C, representing in a similar manner the estimated direction and rate of the current, &c., to be allowed for. Then a line joining the points A and C will represent in the same manner the course and speed which are being made good (over the ground).

A table of factors, by which to multiply the distance run, to obtain the distance of the object when any number of degrees between the two bearings has been observed, is supplied with all chart sets.

The use of a danger angle in passing outlying rocks with land behind should also not be forgotten. In employing this method, however, caution is necessary, as should the chart be not accurate, *i.e.*, should the objects selected be not quite correctly placed, the angle taken off from it may not serve the purpose. It should not, therefore, be employed when the survey is old or manifestly imperfect.

In fixing by the compass, it must always be remembered that two bearings only are liable to error. An absolute error may be made in either bearing observed; errors may be made in applying the deviation; or errors may creep in in laying them on to the chart. For these reasons, a third or check bearing of some other object should be taken, especially when near the shore or dangers. The coincidence of these three lines will prevent any mistakes.

Amongst astronomical methods of fixing a ship's position, attention is drawn to the great utility of Sumner's method. A Sumner line, that is, a line drawn through the position (obtained by an assumed latitude or longitude) at right angles to the bearing of the sun, as obtained from the azimuth tables, gives at times invaluable information, as the ship must be somewhere on that line, provided the chronometer is correct. A deep cast of the lead at the same time may often serve to give an approximate position on the line. An early and very accurate position can also be obtained by Sumner's method, by getting a Sumner line by a bright star at daylight when the horizon is well visible, and another Sumner line by the sun when a few degrees above the horizon, or, better still, by observing two or more stars at twilight. The Sumner lines thus obtained will, if the bearing of sun and star differ three points or more, give an excellent result.

13. *Change of Variation of the Compass.*—The gradual change in the variation must not be forgotten in laying down positions by bearing on charts. The magnetic compasses placed on the charts for the purpose of facilitating plotting become in time slightly in error, and in some cases, such as with small scales, or when the lines are long, the displacement of position from neglect of this change may be of importance. The compasses are re-engraved when the error amounts to a quarter of a point, but the chart plates cannot be corrected more frequently from the impossibility of making alterations often on one spot in a copper plate.

The geographical change in the variation is in some parts of the world sufficiently rapid to need consideration. For instance, in approaching Halifax from Newfoundland the variation changes 10° in less than 500 miles, and in the English Channel about 5° in 400 miles. The Variation Chart should be consulted on this head.

On certain general charts embracing large areas with considerable change of variation, True compasses are placed instead of magnetic compasses, the variation being shown by *isogonic lines* (curves of equal magnetic variation), in a similar manner to the Variation Chart. One or two *isogonic lines* are also sometimes placed on charts, in addition to the magnetic compasses, in order to indicate the general direction of these curves, and thus facilitate the determination of the variation to be employed in portions of the chart not in immediate proximity to any one of the engraved compasses.

14. *Local Magnetic Disturbance of the Compass on board Ship.*—The term "local magnetic disturbance" has reference only to the effects on the compass of magnetic masses external to the ship in which it is placed. Observation shows that such disturbance of the compass in a ship afloat is experienced only in a few places on the globe.

Magnetic laws do not permit of the supposition that it is the visible land which causes such disturbance, because the effect of a magnetic force diminishes in such rapid proportion as the distance from it increases that it would require a local centre of magnetic force of an amount absolutely unknown to affect a compass half a mile distant.

Such deflections of the compass are due to magnetic minerals in the bed of the sea under the ship, and when the water is shallow, and the force strong, the compass may be temporarily deflected when passing over such a spot, but the area of disturbance will be small, unless there are many centres near together.

It is very desirable that whenever a ship passes over an area of local magnetic disturbance, the position should be fixed, and the facts reported as far as they can be ascertained.

15. *Use of Oil for Modifying the Effect of Breaking Waves.*—Many experiences of late years have shown that the utility of oil for this purpose is undoubted, and the application simple.

The following may serve for the guidance of seamen, whose attention is called to the fact that a very small quantity of oil, skilfully applied, may prevent much damage both to ships (especially the smaller classes) and to boats, by modifying the action of breaking seas.

The principal facts as to the use of oil are as follows:—

1. On free waves, *i.e.*, waves in deep water, the effect is greatest.

2. In a surf, or waves breaking on a bar, where a mass of liquid is in actual motion in shallow water, the effect of the oil is uncertain, as nothing can prevent the larger waves from breaking under such circumstances: but even here it is of some service.

3. The heaviest and thickest oils are most effectual. Refined kerosene is of little use; crude petroleum is serviceable when nothing

else is obtainable; but all animal and vegetable oils, such as waste oil from the engines, have great effect.

4. A small quantity of oil suffices, if applied in such a manner as to spread to windward.

5. It is useful in a ship or boat, both when running, or lying to, or in wearing.

6. No experiences are related of its use when hoisting a boat up in a sea-way at sea, but it is highly probable that much time and injury to the boat would be saved by its application on such occasions.

At anchor, when the sea is sufficient to render it difficult to hoist up or in boats, oil bags from forward or from the swinging booms have been found to render the sea alongside comparatively smooth.

7. In cold water, the oil, being thickened by the lower temperature, and not being able to spread freely, will have its effect much reduced. This will vary with the description of oil used.

8. The best method of application in a ship at sea appears to be: hanging over the side, in such a manner as to be in the water, small canvas bags, capable of holding from one to two gallons of oil, such bags being pricked with a sail needle to facilitate leakage of the oil.

The position of these bags should vary with the circumstances. Running before the wind they should be hung on either bow—*e.g.*, from the cathead—and allowed to tow in the water.

With the wind on the quarter the effect seems to be less than in any other position, as the oil goes astern while the waves come up on the quarter.

Lying to, the weather bow and another position farther aft seem the best places from which to hang the bags, with a sufficient length of line to permit them to draw to windward, while the ship drifts.

9. Crossing a bar with a flood tide, oil poured overboard and allowed to float in ahead of the boat which would follow with a bag towing astern, would appear to be the best plan. As before remarked, under these circumstances the effect cannot be so much trusted.

On a bar with the ebb tide it would seem to be useless to try oil for the purpose of entering.

10. For boarding a wreck, it is recommended to pour oil overboard to windward of her before going alongside. The effect in this case must greatly depend upon the set of the current, and the circumstances of the depth of water.

11. For a boat riding in bad weather from a sea anchor, it is recommended to fasten the bag to an endless line rove through a block on the sea anchor, by which means the oil is diffused well ahead of the boat, and the bag can be readily hauled on board for refilling if necessary.

12. Towing a vessel in a heavy sea, oil is of the greatest service, and may prevent parting the hawser. Distribute from the towing vessel forward and on both sides; if used only aft the tow alone gets the benefit.

IN THIS WORK THE BEARINGS ARE ALL MAGNETIC, EXCEPT WHERE MARKED AS TRUE.

THE LATITUDES AND LONGITUDES GIVEN IN THE TEXT ARE APPROXIMATE.

THE VARIATION GIVEN IN THE SEVERAL PAGES IS FOR THE YEAR 1910.

THE BEARINGS OF LIGHTS ARE GIVEN FROM SEAWARD.

THE DISTANCES ARE EXPRESSED IN SEA MILES OF 60 TO A DEGREE OF LATITUDE.

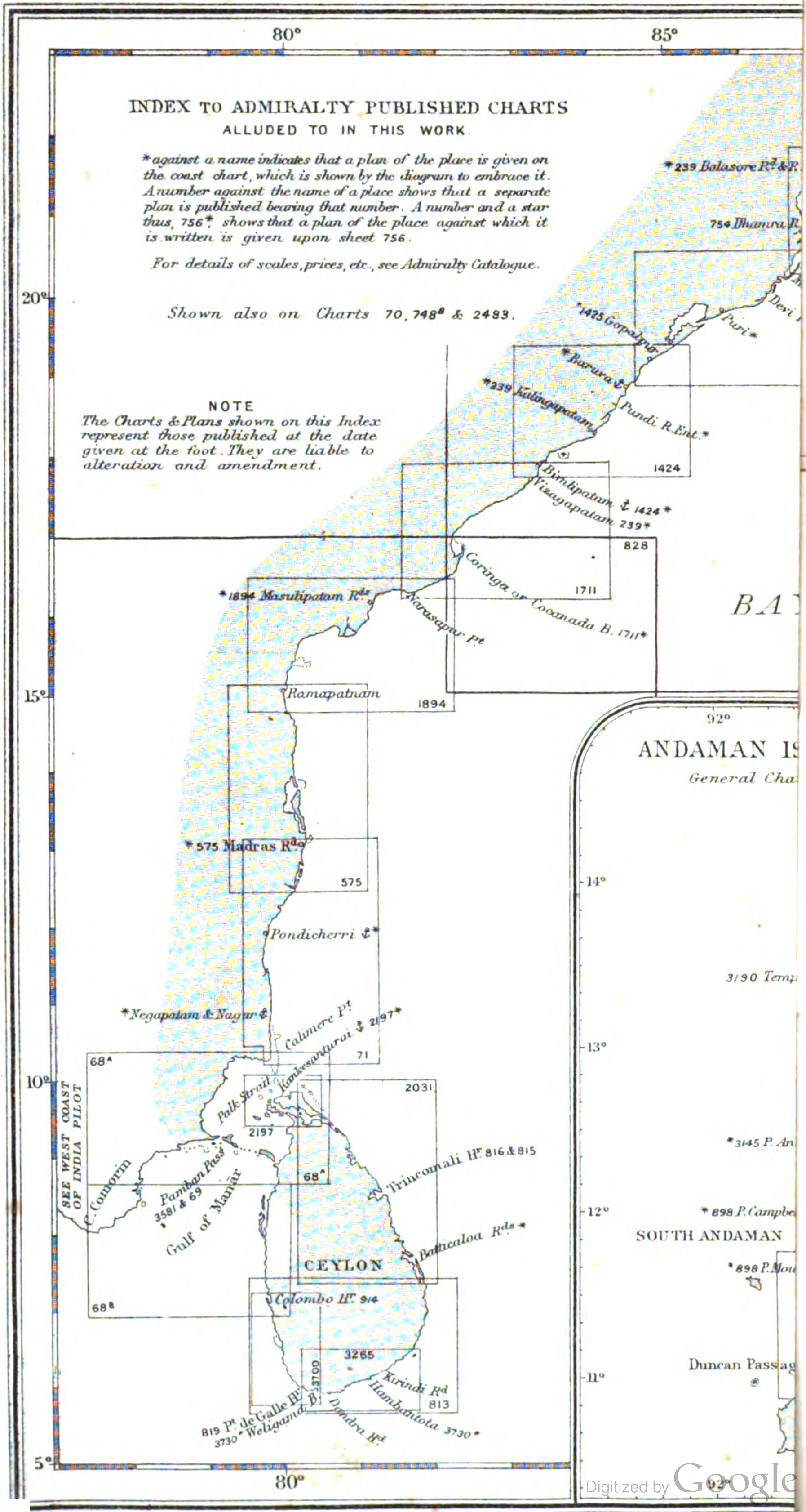
A CABLE'S LENGTH IS ASSUMED TO BE EQUAL TO 100 FATHOMS, OR THE TENTH PART OF A MILE.

THE SOUNDINGS ARE REDUCED TO LOW WATER OF ORDINARY SPRING TIDES.

HEIGHTS ON THE LAND ARE GIVEN ABOVE HIGH WATER OF ORDINARY SPRING TIDES.

WHEN SHADING IS USED TO INDICATE COLOURS OF FLAGS OR BEACONS, IT IS AS FOLLOWS:—

░	▥	▤	■
Yellow.	Red.	Blue.	Black.



INDEX TO ADMIRALTY PUBLISHED CHARTS

ALLUDED TO IN THIS WORK.

** against a name indicates that a plan of the place is given on the coast chart, which is shown by the diagram to embrace it. A number against the name of a place shows that a separate plan is published bearing that number. A number and a star thus, 756*, shows that a plan of the place against which it is written is given upon sheet 756.*

For details of scales, prices, etc., see Admiralty Catalogue.

Shown also on Charts 70, 748B & 2483.

NOTE

The Charts & Plans shown on this Index represent those published at the date given at the foot. They are liable to alteration and amendment.

9 B. Bay of Bengal Pilot.

THE BAY OF BENGAL PILOT.

CHAPTER I.

GENERAL REMARKS ON THE BAY OF BENGAL ; INDIA ; CEYLON ; MADRAS PRESIDENCY AND DISTRICTS ; BENGAL PROVINCE AND DISTRICTS ; BURMA AND ITS DISTRICTS ; NICOBAR AND ANDAMAN ISLANDS. WINDS AND WEATHER ; CYCLONES ; BAROMETER ; STORM AND WEATHER SIGNALS ; CURRENTS ; TIDES ; TEMPERATURE OF SEA ; SOUNDINGS ; COAL ; DOCKS ; REPAIRS ; TIME SIGNALS ; WIRELESS TELEGRAPH STATIONS ; UNIFORM SYSTEM OF BUOYAGE ; MAGNETIC VARIATION ; BRITISH CONSULAR STATIONS ; PASSAGES,—FULL-POWERED STEAMERS ; SAILING VESSELS ; LOW POWER STEAM VESSELS.

Charts 748b, Indian ocean, northern part; 70, Bay of Bengal.

THE BAY OF BENGAL is a considerable gulf of the Indian ocean, triangular in shape, and comprised between the parallels of 8° and 20° N. latitude, and the meridians of 80° and 98° E. longitude. It is bordered on the west by the coasts of Ceylon and of India, and on the east by the coasts of Burma and the Malay peninsula. The distance between Chittagong on the east, and Balasore on the west, at its head, is about 175 miles, and the distance across its mouth, from the Malay peninsula to Cape Comorin, is about 1,200 miles; or, between the southern point of Ceylon and the northern point of Sumatra, about 880 miles.

INDIA, which together with Ceylon, form the western boundary of the Bay of Bengal, is a great irregular triangular-shaped peninsula stretching southwards from Asia into the sea. Its northern boundary is the Himalayan mountain ranges; the chief part of its western side is washed by the Arabian sea, and the most of its eastern side by the Bay of Bengal.

It extends from lat. 8° N. to lat. 35° N., and its greatest length north and south, as well as its greatest breadth east and west, is about 1,900 miles; it tapers with a pear-shaped curve to a point at Cape Comorin, its southern extremity; whilst Burma, the strip of country extending southwards to the eastward of the Indian peninsula, forms

Chart 70, Bay of Bengal.

the eastern shore of the Bay of Bengal. The whole territory thus described contains 1,767,000 square miles, and 294 millions of inhabitants.

Ceylon, a large island, is separated from the south-eastern end of the peninsula of India by the Gulf of Manár and Palk strait.

Of the territories which border the Bay of Bengal, the whole are under British rule, with the exception of that southward of Pakchan river, in the Malay peninsula, which is part of the kingdom of Siam; and the small French colonies of Pondicherri, Karikal, and Yanám or Yanaon, on the western shore of the bay, and Chandernagore, on the Húgli above Calcutta.

Chart 828, Cape Comorin to Cocanada.

CEYLON, an important island lying off the south-eastern part of the peninsula of India, with which it is almost connected by Adam's bridge, is situated between the parallels of 5° 55′ and 9° 51′ N., and the meridians of 79° 42′ and 81° 55′ E. Its greatest length north and south is 240 miles; its greatest breadth is 120 miles; and its area is about 25,365 miles.

The Veddahs, a wild race inhabiting a district in the south-east part of the island, are supposed to be descendants of the aborigines.

Its early history is little known, but Buddha is supposed to have visited the island in the year 543 B.C., and Buddhism became the established religion in 307 B.C. For centuries it was a prey to civil war, and from the fifth to the thirteenth century the Tamils over-ran the island, but in 1410 they were completely subdued.

The Portuguese first visited the island in 1505, and more or less remained until 1630, and in 1639 an alliance was formed between the Sinhalese and the Dutch, who were driven out in 1763, but confirmed in their possession in 1765. The British captured Trincomalí in 1782 and 1795, it having been taken from them by the French in the first instance, and in 1798 the island was made a Crown colony, but the Kandyans gave considerable trouble until it was finally settled under British rule in 1815.

The island is administered under the British Crown by a Governor, assisted by an Executive Council and a Legislative Council of nine officials and eight unofficial members.

Physical features.—With the exception of several isolated hills, rising abruptly from the eastern plain, the remainder of the island is practically flat, and known as the Low country, occupying the entire northern half of the whole area, as well as the wide coastal plain from which the mountain district takes its rise.

The island is densely clothed with tropical forest and jungle, with the exception of an open grass space known as the Patana, which is at the summit of Namuna Kula, where the naval and military camp is situated, or else in parts cleared for agriculture or planting. Large areas on the western, southern, and in some localities on the eastern coasts are densely planted with cocoanut trees.

The chief physical features are the low-lying coast and adjoining districts on the west side, the high range of hills in the centre, which roughly divide the island into two parts, and the bold rocky shores of the south and east coasts.

Mountains.—The mountain ranges are situated almost entirely in the southern part of the Central Province, and the highest peaks are Pedrotalagala or Mount Pedro, 8,326 feet; Kirigalpotta, 7,832 feet; Totapalakanda, 7,746 feet; Kuduhugala, 7,607 feet, and Adam's peak, 7,353 feet. Nuwara Eliya, the sanatorium of the island, is situated at an elevation of 6,240 feet, and the Naval sanatorium, at Diyatalawa, and reached by tram, is 4,367 feet above high water.

Lagoons.—One of the peculiarities of the coastal regions is the extensive fresh and salt water lagoons lying but a short distance from the shore line. These occur on both the east and west sides of the island, and especially in the north, but only to a limited extent in the south.

Rivers.—Owing to the mountainous country and the rainfall, the rivers are numerous, but none are of great length, nor navigable to any appreciable extent, except by native boats, and all have bars and lagoons at their mouths.

Their names and lengths are as follows:—Mahaweli Ganga, 190 miles; Kelani Ganga, 60 miles; Gin Ganga, 70 miles; Welawe Ganga, 80 miles; Nil Ganga, 40 miles; Kálu Ganga, 62 miles; Maha Oya, 80 miles; Dedurn Oya, 85 miles; and Kirinde Oya, 61 miles.

Geology.—The great geological feature of the island is the profusion of gneiss in the mountains, the soil which covers it being almost entirely formed by its decay. The crest of the mountains is of stratified crystalline rock, especially gneiss, through which granite has everywhere intruded. Basalt makes its appearance at Galle and Trincomalí.

Flora and fauna.—The principal timber is coromandel, and besides it ream, jak, ebony, and satin woods are found; in the hills hundreds of square miles have been cleared for coffee and tea estates.

Elephants, supposed to be the best in the world, frequent the forests in the north and north-west, and wild buffaloes, cheetahs, boars, bears, spotted deer, and sambhur comprise the wild animals; monkeys are in great numbers, and crocodiles abound. Snakes infest the island; a number, especially the polonga and the cobra, are poisonous.

Chart 828, Cape Comorin to Cocanada.

Population.—In 1901, the population was 3,565,954, exclusive of military and shipping employés, and consisted of Sinhalese, Tamils, Moors, Burghers, Veddahs, and Malays; Sinhalese and Tamil are the chief languages spoken. The European population was 9,509.

Products.—The principal products are the cocoanut palm and all its products; the areca nut, palmyra, palms, cinnamon, and spices, tobacco, tea, cinchona, india-rubber, rice, cocoa, and coffee are grown, and the island is famous for precious stones. An extensive pearl fishery is carried on.

Cattle are bred, and there is an establishment for breeding ponies on Delft and Iranitiru islands.

The manufactures consist of gold, silver, ivory, and tortoise-shell work, pottery, mats, fans, and wood-carving.

Trade.—The chief exports are tea, cocoanut palm products, plumbago, cinnamon, cacao, areca nuts, and citronella oil; and the imports rice, cotton piece goods, coal, iron, salt fish, sugar, metals, and kerosene oil. In 1908 the exports amounted in value to £8,678,021, and imports to £8,686,127.

In 1908 the ports of the island were entered by 3,533 vessels, with an aggregate tonnage of 6,931,593.

Ports.—Colombo is the principal port, and Trincomalí has a magnificent harbour. Galle was the chief port before Colombo was made. The minor ports are Kankesanturai, on the north; Muletivu and Batticaloa on the east; and Hambantota on the south—all shallow, open roadsteads.

Communications.—Steamships.—The Peninsular and Oriental, the Orient-Pacific, the Norddeutscher Lloyd, and Messageries Maritimes have steamers frequently from Bremen, Antwerp, Southampton, Marseilles, Genoa, and Naples to Australia, Calcutta, the Straits, China and Japan, all calling at Colombo, as also steamers of the Bibby line from Liverpool and Marseilles to Burma.

Other lines calling are the British India, the Bibby, the City, the Nippon Yusen Kaisha, and the Austrian Lloyd between Trieste, Japan, Burma, &c.

The Ceylon Steamship Company have a service of steamers round the island, calling at Galle, Hambantota, Batticaloa, Trincomalí, Point Pedro, Jafnapatam, and Pamban, occupying eight days.

A daily service, in connection with the Indian railway system, is maintained between Colombo and Tuticorin, near the south point of India, steamers leaving each place in the evening and arriving the following morning (16 hours).

Chart 828, Cape Comorin to Cocanada.

Railways.—A coast line runs from Colombo to Matara, a distance of 98½ miles, *viâ* Galle.

The main line from Colombo to Bandarawela, a distance of 160¾ miles, has a branch at Peradeniya to Kandy and Matele, and one at Nanu-oya to Nuwara Eliya.

The Kelani valley line connects Colombo with Yatiyantota, a distance of 47¾ miles.

The Northern line, leaving the main line at Polgahawela, runs north and connects Jaffna peninsula with Colombo, and is in course of extension to Kankesanturai. A branch from Madawachchiya to Talamanaar, at the west end of Manár island, is proposed, to connect with Pamban by steamer and so with the Indian system.

Extensions are in progress between Bandárawela, Bádulla, and Pássara, 25 miles, and a branch to Negombo, a rising town 17 miles north of Colombo, is under construction.

Telegraph.—Ceylon is connected with the Indian telegraph system by cables from Manár to Toniturei, and thence to Mandapam. A cable will be laid from Galle to join the Durban-Perth line wire at the Keeling islands.

All the greater, and most of the smaller, towns are connected by telegraph, there being 2,814 miles of wire in the island, and a telephone system is established in Colombo.

There are excellent roads over most of the island.

Uniform time.—Indian standard time, corresponding to the meridian of 82° 30′ 0″ E. of Greenwich, or 5h. 30m. 0s. in advance of Greenwich mean time, is kept.

Earthquakes.—Recent earthquake shocks experienced were in November, 1897, May, 1904; March, 1907; and August and November, 1908.

Climate.—Owing chiefly to its insular position the climate compares favourably with that of India, and is, on the whole, healthy. There are no violent extremes of temperature, and in the low country the variation of temperature is very small. The mean temperature is 80·7°, the mean maximum 87·3°, and the mean minimum 75·3°. The heat being tempered by sea breezes and by the humidity of the atmosphere, which latter causes constant action of the skin, there is not the same liability to the ill effects on the liver that are produced by hot, dry climates.

The greater part of the rainfall occurs during the South-west and North-east monsoons, but it is so well distributed that there it is rare to have more than three weeks consecutively without rain. The mean annual rainfall varies from 30 to 40 inches in the north-west and south-east to 200 inches in the interior of the island.

Chart 828, Cape Comorin to Cocanada.

Malarial fever, the principal disease, is not of a malignant type. Other diseases, such as cholera, dysentery, enteric fever, are not very prevalent, and the island compares favourably with India in this respect. Chills, especially during the North-east monsoon, should be guarded against. White drill or duck and sun helmets, during the day, and absorbent material, such as Indian gauze, should be worn during the night in preference to flannel; an excess of fruit should be avoided by new arrivals, and alcoholic drinks avoided until after sunset.

MADRAS PRESIDENCY. — General remarks. — Madras, officially styled the Presidency of Fort St. George, occupies, with its dependencies and with the state of Mysore, the entire south of the peninsula of India, with the exception of the small French settlements of Pondicherri, Karikal, and Yanám or Yanaon. The area of British districts is 141,705 square miles, the native states occupying an additional area of 70,000 square miles.

It has a coastline of 1,730 miles, but that included in this work on the west side of the Bay of Bengal only extends from Pamban pass as far northward as the southern end of Chilka lake, and that part of it from Calimere point to about the parallel of 17° N. is known as the Coromandel coast.

The Governor of Madras is assisted by a Council, ordinarily of two members, to whom are added others, not exceeding twenty-one in number. Madras city is the capital.

Mountains.—The Western Gháts which extend the whole length of the western coast, at distances of from 50 to 100 miles from the sea, are from 4,000 to 8,000 feet high, and the Eastern Ghâts, a less marked formation, about 2,000 feet high, back the eastern coast; between these latter and the Bay of Bengal is a broad strip of land.

Rivers.—Nearly the whole trend of the drainage is from west to east into the Bay of Bengal, the three principal rivers being the Godavari, the Kistna, and the Cauvery, all three rising on the western side of the peninsula, and forcing passages for themselves through the Eastern Ghâts; the Godavari and the Kistna have each a course of more than 800 miles. The rivers will be described under the headings of the districts, as also will the Geology, Flora, Fauna, &c.

Population.—The population in British territory, in 1901, was 38,209,436, of which rather more than one million were Christians, about 62 per cent. of these latter being Roman Catholics. An extraordinary number of languages are spoken, but the principal are Tamil, Teluga, Malayalam, Kanarese, Oriya, and Hindustani.

Products.—Cotton, oilseeds, rice, and indigo are grown, and in addition to that from sugar canes, sugar is obtained in large quantities from palms; tobacco, tea, cinchona, and various spices are also produced. Of industries, there are cotton and silk spinning and weaving mills, ivory and metal work, and cigar making. The soil is not naturally fertile, but it has been greatly improved by irrigation systems in the river deltas.

Minerals.—The minerals which occur have so far not been profitable. Gold is washed in some rivers; iron is melted in a primitive manner by the natives; coal of an inferior quality exists near the upper reaches of the Godavari river; graphite is mined, and there are large deposits of magnesite, a rare mineral.

Ports.—Although there is a coastline of over 1,700 miles, there is no good natural harbour; the artificial harbour at Madras was constructed at considerable expense. Cocanada gives partial shelter, and a proposed harbour at Vizagapatam by dredging the river and backwater would enable large vessels to go alongside docks.

Uniform time.—Indian standard time, corresponding to the meridian of 82° 30′ 0″ E. of Greenwich, or 5h. 30m. 0s. in advance of Greenwich mean time, is kept.

DISTRICTS.—The description of the west coast of the Bay of Bengal begins at Pamban pass, in Madura district, from which are the following districts on the coast in the order given:—Tanjore, South Arcot, Chengalpat (Chingleput), Nellore, Guntur, Kistna, Godavari, Vizagapatam, and Ganjam; in addition to these are the small French territories of Karikal, Pondicherri, and Yanám or Yanaon.

MADURA, the southern district of that part of the east coast of Madras Presidency, described in this work, lies between the parallels of 9° 6′ and 10° 49′ N. and the meridians of 77° 11′ and 79° 19′ E., and has an area of 8,701 square miles; the coastline of the district to be described is from Pamban to Tondi, its northern boundary, on the sea coast, being Tanjore district.

The district has probably a more continuous history than any other of the Presidency; first forming the dominion of the Pandyas, about 300 B.C., it appears to have passed to the Cholas in the tenth century, reverting to the original dominion 200 years afterwards, and subsequent to this its history is fragmentary until the sixteenth century, when it became part of the Naik dynasty, passing to the Marathas and Nawabs of Arcot, until 1755, when the British first became connected with it, and was finally ceded to them in 1801.

Physical features.—The general aspect is a level plain, broken in the west by the Palni range, and some isolated hills, also by spurs or outliers of the Western Gháts, and to the south-eastward, sloping gradually to the sea, and bisected by the Vaigai river; the first-named hills extend in an east-north-east direction for a distance of 54 miles, with an average width of 15 miles. Amongst the smaller lines of hills, known as the Sirumalais, the Karandamalais, the Nattam, and the Alagar hills, the highest summit reaches an altitude of 4,400 feet.

Rivers.—The principal river is the Vaigai, rising in the Varushanad hills, flowing south-eastward and through the centre of the district, and entering the sea at Attankarai. Other rivers are the Gundar and Varshalei, the former having a parallel course to the Vaigai, and the latter discharging between Uriyur and Tondi; the smaller rivers are torrents in the rainy season, and small streams at other times.

Geology.—The rocks are chiefly foliated biotite gneiss, probably a gneissose granite, but in some localities coarsely crystalline limestone occurs in the gneiss, and charnockite is found in the western parts. Calcine grits of marine origin fringe the coast from Cape Comorin to Ramen point, and laterite covers a considerable part of the district.

Flora and Fauna.—The flora present no points of special interest, but where the coast has areas of redsand wash, or brackish swamps, it is characteristic of them. The Palni range is the most interesting region from a botanical point, and is worth detailed examination.

The western hills contain all the large game usually found in such locality, as tigers, leopards, bears, elephants, bison (*Gaur*), Nilgiri ibex, sambar, and spotted deer; antelopes are common on the plains, and especially towards the sea.

Population.—In 1901 the population of the district was 2,831,280, of which 91 per cent. were Hindus and 3 per cent. Christians. There are 21 towns and 4,113 villages, and Tamil and a corrupt form of Telugu are the languages generally spoken.

Products.—About three-quarters of the area cropped is devoted to cereals, rice being the principal product, but cotton, oil seeds, gingell, and castor are grown, and Dindigul is famous for its tobacco. Some attention is paid to stock breeding, and the plains afford abundant grazing, fine herds of cattle being found there.

The most important art is silk weaving, and coarse blankets are made; there are cotton spinning mills, and a large cigar factory is in operation.

Trade.—Cotton, silk fabrics, and tea are largely exported, other exports being rice, sheep, and cattle, tobacco, spices, and cardamoms; rice, cattle, sheep, goats, and teak are imported.

Ports.—Pamban and Tondi are the two ports mentioned in this work.

Communications.—Steamships.—Steam vessels belonging to the Ceylon Steamship Company and the British-India S.N. Company use Pamban pass and call at Pamban and Tondi.

Chart 828, Cape Comorin to Cocanada.

Railways.—The main line of the South Indian railway runs through the district and Madura city, with a branch to Mandapam, from which it is to be continued to Dhanush Kodi, at the east extreme of Pamban island, crossing Pamban pass by a masonry viaduct and bridge in course of construction, and connecting with Ceylon by steamers; several new railway lines are also proposed.

Climate.—The climate is hot, dry, and variable, with no real cold season in the plains, although the air is pleasantly cool from November to February; owing to the prevalence of malarial fever, the district cannot be considered as healthy. The mean temperature at Madura city is 84° but it is considerably less at Pamban, and the climate of the Upper Palnis is probably one of the finest in India.

The rainfall, omitting the Palni range, is from 26 to 36 inches, and averages about 30 inches, more than a half of that amount falling during the last three months of the year, but it varies considerably in different parts.

TANJORE, a district lying northward of Madura district, between lat. 9° 49′ N. and lat. 11° 25′ N., and long. 78° 47′ E. and long. 79° 52′ E., has an area of 3,710 square miles. It is bounded on the south-west by Madura district and on the north by Coleroon river, which separates it from Trichinopoli and South Arcot districts. Its seaboard consists of two sections, one bordering Palk strait for 68 miles, from the Madura boundary to Calimere point; the other from Calimere point to Coleroon river, a distance of 72 miles; the small French territory of Karikal is situated about the middle of the latter section.

About the middle of the tenth century the district formed part of the Chola kingdom, but passed from them in the thirteenth century, and in the fourteenth became part of the Hindu kingdom of Vijayanagar. The British first came into contact with Tanjore by their expedition in 1749, with a view to the restoration of a deposed Raja. In 1799 the Raja Sarabhoji resigned the district into the hands of the British, but still exercised certain sovereign authority, and, in 1855, his son dying without heirs, the whole became British territory.

Physical features.—The northern and eastern portions of Tanjore form the delta of the Cauvery river, which, with its numerous branches, intersects and irrigates more than half the district, and this is the most densely populated area. It is a level alluvial plain, covered almost without a break by rice fields, and sloping gently towards the sea, with the villages half hidden by cocoanut palms, and is devoid of forests, with no eminences except ridges and dunes of blown sand, which fringe the coast. The non-deltaic part of the district, about 50 feet higher, is likewise an open plain, sloping to the east and destitute of hills.

Rivers.—Cauvery river, a great river of southern India, rises in the Western Gháts in lat. 12° 25′ N., long. 75° 34′ E.; it then flows south-eastward across the plateau of Mysore, and finally enters the Bay of Bengal by two principal mouths in the district of Tanjore. Its length is about 475 miles.

The Cauvery enters the Presidency of Madras at the falls of Sivasamudram, and passes into Trichinopoli, and at this part of its course is the historic Trichinopoli rock, where the Cauvery breaks into two channels, the northern of which is named the Coleroon, which enters the bay southward of Porto Novo, and is navigable for small craft for a few miles above its mouth.

The Vettar, another river in this district, enters the bay at Nagar.

Geology.—The south and south-west portions of Tanjore are occupied by unfossiliferous conglomerates and sandstones lying on an irregular surface of gneiss, and above them, in a series of flat terraces, are lateritic conglomerates, gravels, and sands, which gradually sink below the alluvium. The northern and eastern tracks are composed of river, deltaic, and shore alluvium, and blown sands.

Flora and fauna.—Bamboos and cocoanut palms are plentiful in the delta, palmyras and the Alexandrian laurel on the coast, tamarind, jak, and nim in the uplands of the south, while the iluppai (*Bassia longifolia*) and the banyan and other figs are common everywhere.

Antelopes, spotted deer, and wild hogs are found in the scrub jungle near Calimere point, also in other very small areas, but otherwise there are no wild animals larger than a jackal; these and foxes are very common. Ordinary game birds are found in fair quantities, and the rice fields afford good snipe shooting.

Population.—The population of the district in 1901 was 2,245,029, of which 86,974 were Christians, and 91 per cent. Hindus. Tamil is the general language spoken.

Products.—The fertility of the delta depends on the quantity of silt brought down by the Cauvery, and rice is grown in both June and August, so as to take advantage of the two rainy seasons, but the deposit is so rich that the use of manure is very rare. The richest land lies near the apex of the delta, the fertility decreasing as the coast is reached; the poorest land is towards the south-west. Rice is therefore the staple grain of the delta, but varaga, cambu, and ragi are also grown, and tobacco, plaintains, and bamboos.

On account of the delta being so closely cultivated it contains little grazing ground, so few cattle or sheep are bred, and plough bullocks are largely imported.

Chart 828, Cape Comorin to Cocanada.

The chief industries are various kinds of weaving, and metal work for which Tanjore is somewhat celebrated.

Minerals.—There are few minerals of importance; quartz crystals are found at Vallam, and laterite and limestone are abundant in the south-west district. Yellow ochre and gypsum, of poor quality, are found.

Trade.—The principal export is rice, and, in addition, cotton piece goods, live stock, cigars, tobacco, skins, timber and areca nut are shipped; inland exports are betel leaf, ground nuts, oil, metal vessels, and cloths. The imports include salt, gingelly and cotton-seed, kerosene oil, tamarinds, chillies, pulses, &c.

Ports.—The principal ports, all open anchorages, are Negapatam, Nagar, and Tranquebar.

Communications. — **Railways.** — From Adraimpatnam a line runs to the north-eastward and northward to Mayaveram and Negapatam, with a branch to the south-westward to Arantangi, and the South Indian railway traverses the district in an east-north-east direction, passing through the towns of Tanjore, Kumbakonam, and Mayaveram.

Climate.—Although the delta is hot and relaxing, the climate is generally healthy, and the increased breadth of the irrigated land, as the delta widens, causes more rapid evaporation of the water with which it is covered, rendering that part cooler than the sea. The mean temperature at Negapatam is 80°. A swamp westward from Calimere point, causes a great exception to the general healthiness, and this district is said to be malarious from April to June.

The annual rainfall, which is about 44 inches, is lowest at Arantangi and highest at Negapatam, where it is 36 and 54 inches respectively; most of the fall is during the North-east monsoon.

KARIKAL.—Between Mayaveram, Nannilam, and Negapatam is the small territory of Karikal, belonging to the French, which has an area of 53 square miles. It was first promised to the French, in return for assistance, by an exiled Raja, in 1738, but they did not obtain complete possession till 1754, and subsequently it came into the possession of the British on four different occasions, being finally restored to the French in 1817.

The settlement is divided into three communes, containing 110 villages, and is governed by an Administrator subordinate to the Governor of Pondicherri.

Population.—In 1901 the population was 56,595, and is rapidly decreasing.

Products.—The country is very fertile, being irrigated by seven branches of the Cauvery river, and the capital is situated on the north bank of the Arasalár, about 1½ miles from its mouth. Owing to its close proximity to Negagatam, the trade has been very limited, but in 1908 it was said to be increasing. An American firm have built large iron tanks for the storage of kerosene oil, with a view to supplying the market in the interior.

Trade.—In 1907 the port was entered by 137 vessels with an aggregate tonnage of 255,461 tons.

Ports.—Karikal, the port, is merely an open roadstead.

Communications.—Steamships.—Vessels of the British India, Messageries, Maritimes, Clan, and Asiatic lines call here.

Railways.—Karikal is connected with Peralam, on the Tanjore District Railway by a line 14¾ miles in length.

SOUTH ARCOT, the district joining the north side of Tanjore is supposed to derive its name from *arukadu*, or six forests, that being the number with which it was credited. It lies between the parallels of 11° 11′ and 12° 15′ N., and the meridians of 78° 38′ and 80° 0′ E., and has an area of 5,217 square miles; its northern boundary is North Arcot and Chengalpat, and within it lies the French territory of Pondicherri.

The early history is probably the same as the rest of the Chola country, but before the British connection in 1674, it was also in the hands of the Pallavas and Mahrattas. Fort St. David and all the country " within the randome shot of a great gun " was purchased from the Mahrattas in 1690, but the district only passed for the first time under British rule in 1781, and was ceded in full sovereignty to that country in 1801.

Physical features.—On the western side the Kalrayan hills, from 3,000 to 4,000 feet high, are connected with the Shevaroys, and farther north is part of the Javadi hills; in the western and north-western parts are small rocky hills appearing in isolated groups, the most remarkable being Tiruvannamalai, a peak 2,668 feet high, with long sloping sides mostly covered with jungle.

The remainder of the district is a flat plain, with a few sand ridges near the coast.

Rivers.—The rivers all flow from east to west, and Ponnaiyar, the principal one, has a course of 75 miles, in a sandy bed, with low banks, and no tributaries of any consequence, falling into the bay 3 miles northward of Cuddalore.

In the extreme south, the Vellar, flowing for 82 miles through the district, has high banks, and enters the bay at Porto Novo, being tidal for 7 or 8 miles from its mouth; it forms the boundary between South Arcot and Trichinopoli.

Chart 828, Cape Comorin to Cocanada.

The Coleroon has been already mentioned with Tanjore, and both it and the Vellar are navigable for a short distance from their mouths by small boats.

The Gadilam, southward of the Ponnaiyar, and connected to it by a natural channel named the Malattar, runs into the bay close to the mouth of the Ponnaiyar, after a course of 59 miles. Northward of the Ponnaiyar is the Gingee or Varahanadi river, entering the bay near Pondicherri.

Geology.—Archaean gneisse and schists, with very massive gneissose, granite, and hornblendic rocks, &c., are the chief geological features of the greater part of the district, and there are also unfossiliferous, ferruginous, soft sandstones and grits, with river, deltaic and coast alluvium, and blown sand in all the low-lying areas.

Flora and fauna.—In the hills there is an abundance of sandal wood (*Zizyphus* and *Terminalia*) and more rarely teak and black wood, while in the plain between the hills and the sea is a mixture of deciduous and evergreen flora; along the coast are the brackish water forms, in the salt-water marshes, and seaside coast flora along the beach; of these the seaside convolvulus and spinifex are conspicuous.

Leopards, bears, sambar, spotted deer, and wild hogs, and some smaller game, are found in the hills, and on the low ground are partridges, hares, quail, peafowl, jungle fowl, and rock pigeons, while teal, wild ducks, and snipe are numerous.

The principal sea fish are the pomfret, the sole, the whiting, the rubal, and the valai, a species of silurus.

Population.—In 1901 the population was 2,349,894, of which 94 per cent. were Hindus, and of the Christians 92 per cent. were Roman Catholics.

Products.—Rice is extensively grown, and cambu, varagu, and ragi are the chief staples in some parts; fruit and vegetables are grown in the vicinity of Cuddalore. Ground nuts form the most important industrial crop, gingelly is grown all over the district, and a considerable area is covered with indigo.

Cattle are raised, and two kinds of sheep, one woolly and the other a hairy breed; goats are principally valued for their skins. The forests are not important, and are at present principally used for grazing.

Indigo, salt, coarse sugar, pottery, oils, and cotton fabrics are largely manufactured, the indigo and steam sugar factories employing a number of hands. Weaving in cotton mixed with silk is also practised.

Minerals.—The district is not noted for any mines or minerals, but fine grain sandstones, plastic clay, and excellent granite are found.

Chart 828, Cape Comorin to Cocanada.

Trade.—The chief exports are ground nuts, oilcake, cotton piece goods, skins, rice, ground nut oil, fresh vegetables, turmeric, tobacco, cigars, chillies, coriander, and castor. This district does the largest trade in ground nuts in the presidency. Areca nuts, palmyra timber, cattle, fruit, and vegetables, and many foreign-made articles, are imported.

Ports.—Porto Novo and Cuddalore are the ports, the latter being by far the more important of the two.

Communications.—Steamships.—The coasting steamers of the British India Company call periodically at Cuddalore.

Railways.—The South Indian Railway runs for a distance of 88 miles through the district, with stations at Porto Novo and Cuddalore, and at Villapuram there is a branch, 24 miles in length, to Pondicherri. From Villapuram there is also a line to Dharmavaram, in the Anantapur district.

There is a total length of 1,218 miles of roads in the district, of which 901 miles are metalled.

Climate.—The climate of the district is fairly dry and generally healthy, but malaria is endemic in some parts, epidemic cholera is frequent, and elephantiasis is met with at some places along the coast. The temperature is moderate near the sea, the mean at Cuddalore being 82°, and average maximum and minimum 91° and 74° respectively.

The district depends on the monsoons for its rains, which are greatest near the coast (52 inches), and get less farther inland, where they are 39 inches, the average annual fall being 43 inches.

PONDICHERRI, the chief French settlement in India, is situated about 12 miles north of Cuddalore, and has an area of 115 square miles. Founded in 1674, it was captured by the Dutch in 1693, but restored in 1699. The British besieged it four times—in 1748, in 1761, in 1778, and in 1793; the first siege was unsuccessful, and after the others the territory was restored, being finally given up to the French in 1816. The settlement has a number of isolated pieces of territory, surrounded by the British district of South Arcot.

Population.—In 1901, the population was 174,456.

Products.—Weaving is the chief industry of Pondicherri, and there are four cotton mills, also a factory for the manufacture of cocotine, a substitute for ghi.

Trade.—The principal exports are ground nuts, shelled and in husk, oil cakes, cotton cloth, thread cotton, blue cloth, dried fish, hides, and rice, and imports cotton, pulse, grain, &c., gunny bags, areca nuts, wines, spirits, and shirtings; during the year 1907 the port was entered by 167 vessels, with an aggregate tonnage of 403,246 tons.

Port.—Pondicherri is a free port, but there is no real harbour, and vessels lie about a mile from the shore.

Communications. — Steamships. — Vessels of the British India, Messagerie Maritimes, Clan, and Asiatic lines call regularly, and others, chartered for ground nuts, visit the port.

Railways.—Pondicherri is the terminus of the Villupuram-Pondicherri branch of the South Indian Railway, and is distant 122 miles by rail from Madras city.

Climate.—The climate is probably similar to that of South Arcot.

CHENGALPAT (CHINGLEPUT), the district joining South Arcot, on the north, lies between the parallels of 12° 15′ and 13° 47′ N., and the meridians of 79° 34′ and 80° 21′ E., and has an area of 3,079 square miles; it is bounded on the north by Nellore district, and contains within its limits the city of Madras.

From the earliest records, Chengalpat formed part of the ancient kingdom of the Pallavas, until their extinction in 760, and shortly afterwards it became part of the Chola country. From 1393 to 1565 it belonged to the kingdom of Vijayanagar, and in 1639 the British received the grant of the site on which Fort St. George now stands, but it was not till 1801 that it became part of the British possessions in India.

Physical features.—The district is flat and dreary near the sea, but undulating, and even in some places hilly, elsewhere; in the extreme north of Nagalapuram hills, about 2,500 feet, and the ridge of which the highest peak is the well-known Kambakam Durgam, 2,546 feet, contribute a few picturesque effects.

Rivers.—A series of streams, flowing from west to east, cross this district, the largest being the Palar, which, rising in Mysore, runs into the bay 3 miles southward of Sadras.

Cotteliar river, the next important, falls into the backwater at Ennore, northward of Madras city.

Other rivers are the Arani, which reaches the bay near Pulicat, and the Cooum, discharging near Fort George; besides these are the Cheyyar and the Adyar, two smaller streams.

Geology.—Archaean gnessic and plutonic rocks emerge from the younger sedimentaries in the south and south-west part, and on these are plant-bearing shales, containing plants associated with sandstones and micaceous sandy shales and conglomerates, containing some ill-preserved ammonites and bivalves, as well as plants.

In other places, above the plant-bearing shales, are thin beds of conglomeratic laterite, together with laterite red sands and loams. Along the coast and in the river beds are alluvium and blown sand.

Flora and fauna.—The most noticeable trees amongst the villages are the palmyra palm and the casuarina, the latter being planted all along the sandy soil which borders the sea coast. The plants found throughout the district resemble those of similar areas on the east coast.

The larger kinds of wild animals are scarce, but an occasional tiger, a few leopards, and some bears are found among the hills in the north, also small numbers of spotted deer and sambar; here wild hogs are fairly numerous in the low hills and scrub jungle. The district is famous for snipe, and florican are more common than usual.

Population.—The population of the district, in 1901, was 1,312,122, and owing to the proximity of Madras city it contains a large proportion of Europeans and Eurasians. Telugu is the language generally used.

Products.—The staple grains are rice and ragi, the other crops being varagu, indigo, gingelly, cambu, and ground nuts, but much of the soil is poor. There is little real forest, and it is chiefly used as grazing ground, but the cattle raised are mostly inferior.

Cotton and silk weaving are the most important occupations; there are some tanneries, paper-making establishments, and there is a cigar factory.

Trade.—The chief trade of the district is in supplying the city of Madras with ordinary local products, such as cowdung fuel, firewood, grain, vegetables, meat, straw, grass, sand, laterite, bricks, &c.

The imports are principally kerosene oil, European goods, and metals.

Ports.—Although the district has a long seaboard, with the exception of Madras, it possesses no place that can be called a harbour.

Communication.—Steamships.—There is communication with Calcutta, Bombay, Rangoon, and the Straits by steam vessels of the British India Company.

Railways.—The main line of the South Indian Railway from the southward of the district, crosses the Palar river by a girder bridge, and runs to Madras. The East Coast line of the Madras Railway, from Madras, runs to the northward and north-westward into Nellore district, and the south-west line of the same railway runs west into North Arcot, the main line connecting with the Great Indian Peninsula Railway to Bombay. A branch line from Chengalpat town runs north-west to Arkonam junction.

Chart 828, Cape Comorin to Cocanada.

The district has 717 miles of roads, nearly all metalled, and about 600 miles have avenues of trees.

The Buckingham canal, running along the whole coast of Chengalpat, utilises the backwaters with which the whole shore is fringed, and gives direct communication with South Arcot and with the north as far as Godavari.

Climate.—The climate, considering the latitude, is temperate like other districts in the southern part of the province, the mean annual temperature of Madras being 83°, and although fever is endemic in some places in the west, and leprosy and elephantiasis in the east, it is generally healthy.

The rainfall varies in different localities, and is neither copious nor very regular. The average fall throughout is 45 inches, being greatest near the coast, where it is 51 inches, the greater part falling in the last three months of the year.

NELLORE, bounded on the south by Chengalpat, and on the north by the Guntur district, lies between the parallels of 13° 29′ and 16° 1′ N., and the meridians of 79° 5′ and 80° 16′ E., and previous to 1904, had an area of 8,761 square miles; it is the second largest district in the presidency of Madras.

It was apparently a part of the Chola kingdom previous to the thirteenth century, when it passed to the Pandyas, becoming a Hindu kingdom in the following century. The British connection dates from 1625, and in 1781 it first passed under direct British management, being ceded in full sovereignty in 1801.

Physical features.—The country rises very gradually to the Eastern Gháts, on the west, and the scenery is uninteresting, being generally wide extents of scrub jungle, but fine groves are occasionally met with in the vicinity of villages and tanks, with, in places, stretches of bright green rice.

Of the backwaters which separate the district from the sea, Pulicat lake is the best known; the Kistnapatam backwater has a depth of over 30 feet in the hot season, at low water, but a bar, on which there is only 5 or 6 feet, blocks the entrance.

Rivers.—The principal rivers of the district are seven in number, but none are navigable except the Vupatteru, which allows boats drawing 2 or 3 feet water to ascend it for about 25 miles.

The Suvarnamukhi, the southernmost, rising in the Chittoor hills, flows for 30 miles and enters the bay 9 miles north of Armagon.

The Vupatteru, already mentioned, runs into the bay near Kistnapatam, and is tidal as far as Gudur, and northward of it is the Penner, the most important, on which is the town of Nellore; rising in Mysore, it has a course of 285 miles.

Further north, the other rivers are the Munyeru, the Paleru, the

Musi, and the Gundlakamma, which latter forms the boundary with Guntur district.

Geology.—The central area is Archaean, and eastward of a north and south line through it are gneisses or schists, with some very micaceous pegmatites, which have given rise to a considerable mica industry. Westward and south-westward of the central area are gneissoid granite, augite, &c., and some plant-bearing sandstones and shales. A narrow belt of alluvial and backwater deposits, from 2 to 14 miles wide, runs close to and parallel with the sea.

Flora and fauna.—Large trees, which are uncommon and generally found near villages, include the margosa, and various species of ficus, the tamarind, the acacia, and the mango. The palmyra and cocoanut palm and the bastard date are found near the coast. A large part of the district is covered with low jungle scrub, in which the red-sanders tree and the satinwood, with a few other useful species, occur.

Tigers occasionally wander across the border from the Cuddapah hills, and bears are found on the Ghâts and other hills, but are not plentiful. Leopards, hunting leopards, sambar, gazelle, and wild hogs are fairly common, and, of birds, the snipe and the florican are tolerably plentiful; the Indian bustard is occasionally seen.

Population.—There are 10 towns and 1,758 villages, and in 1901 the population was 1,496,987, of which nearly 60,000 were Christians and 90 per cent. Hindus. This was prior to the formation of Guntur district.

Products.—The soil is fairly good near the sea, but generally poor further westward, and rice and cholam are the principal crops; tobacco, cotton, and indigo are grown, and castor is an important crop everywhere. The breed of heavy cattle is celebrated, but sheep and goats give very poor meat.

Beyond agriculture and cattle breeding, the industries are on a very small scale. The cloth is of the commonest description, and some rough woollen blankets are woven; brass and copper utensils are made in several localities. Country carts with stone wheels are made, and tanning skins is carried on.

Minerals.—Iron ore is widely distributed, and there are large beds of magnetic iron, gypsum, garnet, laterite, crystalline limestone, sandstone, and greenstone are all found, and it is said that diamonds have been discovered.

Trade.—The principal exports are rice, grains, indigo, cotton, ghi, salt, oilseeds, condiments, firewood, salt fish, hides, horn, tobacco, limecloth, and brass and copper vessels. Of imports, the chief are hardware, petroleum, sugar, and spices. There is a large trade in cattle.

Chart 828, Cape Comorin to Cocanada.

Ports.—There are no ports with any sea-borne trade, and the Buckingham canal is the only navigable waterway.

Communications.—Railways.—The East Coast line of the Madras Railway traverses the whole district from north to south. Entering it 38 miles north of Madras, it leaves it, after running 153 miles roughly parallel to the coast, immediately northward of Ammanabrolu. From Gudur there is a line to Tirupati, and the Southern Mahratta Railway passes through the north-west part of the district.

Climate.—The climate is dry and fairly healthy, being subject to no sudden changes of temperature, but for two or three months of the year, when the westerly wind blows, the heat is excessive; owing to the sea breeze, that tract of country near the sea is generally cooler than inland. This district is regarded as one of the hottest in the presidency, the average temperature at Nellore varying from 77° in January to 94° in May, the thermometer rising on some days to 112° in the shade. The mean annual temperature is 85°.

The rainfall is capricious and uncertain, being generally heavier on the coast than inland; the average at Pulicat lake is 41 inches, while it is 36 inches in the south, 32 inches in the north-east, and 26 inches in the north-west of the district; as small a rainfall as 11 inches has been registered in one year.

GUNTUR DISTRICT, which joins Nellore on its north-east side, was formed, for administrative purposes, in 1904, and extends to the west bank of the Kistna river, having an area of 5,733 square miles, and a coastline of about 66 miles; the only river of any importance is the Kistna.

Population.—In 1901 the population was 1,495,635.

Ports.—Kottapatam and Nizampatan are the principal ports.

KISTNA, the next district to Guntur, on the north, is bounded on its north-eastern side by Godavari, and lies between the parallels of 15° 43′ and 17° 9′ N., and the meridians of 79° 14′ and 81° 33′ E.; prior to 1904 it had an area of 8,498 square miles, and is named after the large river, which, flowing along its western boundary, turns sharply from north-west to south-east, and forms its most striking feature.

From the Buddhist dynasty, its earliest rulers, the district passed through a number of hands, and it was not until 1750 that the political influence of any European power was brought to bear on it, when it passed to the French, and then to the British, becoming the territory of the latter in 1801.

Physical features.—The extreme west of the district consists of stony uplands, with rocky hills or low ranges, the central and

Chart 828, Cape Comorin to Cocanada.

northern portions are a level plain of black cotton soil, but the eastern part is the wide alluvial delta of the Kistna river, an almost flat expanse, covered with irrigated rice fields and containing some of the most fertile land in the presidency. The coast is fringed with a belt of blown sand, sometimes extending inland for several miles, and with dunes from 30 to 50 feet high.

The only hills, which are outliers of the Eastern Gháts, are on the western side, and the Colair lake lies within the district.

Rivers.—The Kistna river, the only one in the district, rises in the Western Gháts, about 40 miles from the Arabian sea, and has a total length of 800 miles, being one of the largest rivers in southern India. In its course it receives a number of tributaries, viz.: the Koyna, the Varna, the Panchganga, the Ghátprabba, the Malprabba, the Bhima, the Tungabhadra, and the Musi, which is its last important feeder; and from the Eastern Gháts it flows for 100 miles between the Kistna and Guntur districts, at which point it is first largely used for irrigation.

At Bezwada, at the head of the delta, the river is thrown out into a network of irrigation canals from a masonry dam, and here the East Coast Madras railway crosses it on a girder bridge, and it is said that the velocity of the current is about 6½ miles an hour when the river is in flood. The river is only navigable below the dam, between which and its mouth sea-going native craft ply on it for six months of the year.

Colair lake, the only large natural fresh-water lake in the Madras presidency, is a large, shallow depression, half lake, half swamp, and, roughly, elliptical in shape; its extent varies greatly, as, during the monsoon, it exceeds 100 square miles, while in the dry season it shrinks considerably, and even sometimes dries up altogether.

It has two outlets, the Perantala Kanama and Juvir Kanama, and passes into the tidal stream of the Upputeru, and thence to the sea.

Canals.—From the masonry dam above mentioned, which is 3,714 feet wide and 20 feet above the bed of the stream, there are ten principal canals leading to every part of the delta, and 307 miles of these are navigable.

Geology.—Archaean gneisses cover the belt of low-lying country at the foot of the Eastern Gháts, and north-westward of this there is more elevated country of unfossiliferous sedimentary strata, comprising quartzitic and shaly sub-series, with occasional conglomerates and limestones. South-east of the Archæan band are plant-bearing sandstones and shales, and Jurassic marine shells, and there are great stretches of coastal and deltaic alluvium.

Flora and fauna.—The district, generally speaking, is very bare of tree growth, but considerable areas of the sandy wastes along the coast have been planted with casuarina, and a light wood, named ponuku, used in the manufacture of toys, is found in the hills. The plants are merely the usual cultivation weeds of this coast.

Wild animals are not plentiful, but tigers and sambar are found in some of the jungles and on the hills. A few antelope are seen, and wild hogs are not uncommon in various parts. Almost every species of South Indian feathered game, except woodcock and hill partridge, may be found in the district, and Colair lake holds all the known aquatic birds, and is also fairly stocked with fish.

Population.—In 1901 the population of the district was 2,154,803; of these about 100,000 were Christians and 89 per cent. Hindus; Telugu is the prevailing language. This was prior to the formation of Guntur district.

Products.—Rice is the staple crop, and cholam and cambu are also extensively grown; cotton, indigo, tobacco, and castor are the principal industrial crops. The large extent of pasture in the upland regions affords exceptional facilities for rearing stock, and excellent cattle are raised: sheep are also fairly plentiful.

The arts and manufactures are few, but weaving coarse cloth from sheep and goat wool is carried on all over the district; there are steam cotton presses and ginning factories; toys are made, and there is a tannery.

Minerals.—Iron occurs in small quantities, and copper was formerly found; the diamond mines, worked before the British occupation, are said to have produced some of such celebrated stones, as the Pitt or Regent and, it is supposed, the Koh-i-noor.

Trade.—Cotton, rice, castor seeds, tobacco, and chillies are the principal exports, and amongst the imports are coarse sugar, spirits, piece goods, and kerosene oil.

Ports.—Masulipatam and Narasapur are the two seaports.

Communications. — Steamships. — The British India Steam Navigation Company have a regular service of steam vessels to Masulipatam.

Railways.—The most important railway is the East Coast line of the Madras railway, which, entering the district from Nellore, at its southern corner, runs through it for 93½ miles, and passes into Godavari; it crosses the Kistna river on a twelve-span girder bridge. Bezwada is also the terminus of the Guaranteed State and Southern Mahratta Railways; the former leaves the district at 21½ miles from Bezwada, and the latter has a length of 79 miles within it. A line is in course of construction from Masulipatam to Bezwada.

There are 709 miles of metalled roads, and nearly that length planted with avenues of trees.

Chart 828, Cape Comorin to Cocanada.

Climate.—The climate, although trying on account of the great heat, is fairly healthy, and fever is, on the whole, uncommon. Masulipatam has a mean temperature of 82°, and a recorded shade temperature of 117°, the minimum being 58° and, except for a short time in May, the heat is never unbearable.

The annual rainfall of the whole district is 33 inches, but it is not evenly distributed, and two-thirds of it falls during the South-west monsoon, the remainder falling in the last three months of the year.

GODAVARI, bounded by Kistna, on its south-west side, and by Vizagapatam on the north-east, lies between the parallels of 16° 19′ and 18° 4′ N., and the meridians of 80° 52′ and 82° 36′ E., and has an area of 7,972 square miles.

The earliest rulers of the country were the Andhras, from which it passed to the Asokas and Pallavas, and then to the Cholas till the end of the thirteenth century. In the fourteenth century the Mohammedans appeared on the scene, and there were various changes. The first European settlement was founded in 1652, and in 1765 the district passed to the British. In 1879 certain taluks and the Rampa hill country were constituted an agency, giving extended powers to the Collector.

The French possession of Yanám or Yanaon is included in this district.

Physical features.—The north-western angle of the district, known as the agency tract, is almost entirely occupied by a portion of the range of the Eastern Ghâts, consisting of scattered hills and spurs; the highest peak is Peddakonda, 4,476 feet high. The Godavari river, from which the district takes its name, runs directly through the centre of the district, dividing, at 40 miles from the sea, into two branches, and flowing through a wide delta formed by its silt, and from this to the sea the country is a vast expanse of rice fields, dotted with gardens and villages. The alluvial tracts on the right and left banks of the river are designated as the Western and Eastern Deltas.

Rivers.—The Godavari river, for utility, sanctity, and picturesque scenery, is only surpassed by the Ganges and Indus, and, rising in Nasik district, Bombay, only 50 miles from the Indian ocean, flows in a south-east direction for about 900 miles. Its tributaries are the Darna, the Kadva, the Pravara, the Mula, the Purna, and Manjra, the Maner, the Pranhita, the Wardha, the Wain Ganga, the Indravati, the Tal, and the Sabari.

The head of the delta of this river is at Dowlaishweram, in the Godavari district, and 40 miles in a straight line from the Bay of Bengal, and here it bifurcates, forming the Vasishita Godavari, on the west, and the Gautami Godavari on the east; above the bifurcation is a

Chart 828, Cape Comorin to Cocanada.

masonry dam or anicut, formed of two parallel walls, 2¼ miles in length, and 42 feet apart. The river is navigable for small boats throughout the district, and above the dam there are several Government steam vessels.

There are no other rivers of any consequence in the district.

Canals.—Three separate canal systems branch off from below the dam, of which there are 493 miles of main canal, all navigable; in addition to this there are 1,929 miles of distributary canals.

Geology.—The geology of the district is somewhat complicated, with Archaean gneissic rocks in its north-west portion, and on the other formations rest the deposits of the plains and of the Godavari valley.

Flora and fauna.—The forests are of great value, and situated chiefly within the agency limits. The principal tree is the teak, and of items of minor produce are the tamarind and myrabolams; along the coast are large tracts of mangrove swamps, and there are three casuarina plantations. The physical formation of the district permits the existence of several distinct floras, and, bordering the river and in the rapids, *Euphorbia Lawii* flourishes, and some exotic ferns are found on its banks.

Bison frequent the tablelands, and wild buffalo are occasionally met with, while in the plains antelope, spotted deer, and wild hogs are to be found in several localities. The district is rich in bird life, and among the rarer birds are the imperial pigeon, pied myna, and bhimaraj. The large sable fish is caught in considerable quantities at the dam across the Godavari river, and soles are plentiful off the coast.

Population.—In 1901 the population was 2,301,759, of which only about 17,000 were Christians, and 97 per cent. Hindus; there are 2,678 towns and villages, nearly one-half being in the agency. Telugu is the language generally spoken.

Products.—Rice is grown on about half the area cropped; next comes cholam, and pulses, chiefly horse gram and green gram. Of the industrial crops, oilseeds, tobacco, sugar cane, and indigo may be mentioned, and a large area is under orchard and garden crops. There are no distinctive breeds of cattle, but large flocks of sheep and goats are kept.

Coarse cotton cloths and woollen blankets are made, also woollen carpets; there are sugar, rice husking, castor oil, indigo, cheroot, and salt factories, fish-curing yards, and a small iron foundry.

Minerals.—Prospecting for coal has been carried on for some years, and although two outcrops have been found, no paying seam has been discovered. Graphite is worked; there are traces of iron

Chart 828, Cape Comorin to Cocanada.

workings throughout the agency, and in the delta are two small deposits of sulphur.

Trade.—The exports from the district consist almost entirely of agricultural produce, the chief items being rice and other grain, tobacco, oilseeds, ghi, cocoanuts, hides, and fruit, and cotton brought from Deccan, is largely exported. The principal imports are cotton twist and yarn, piece goods, grain and pulses, kerosene oil, gunny bags, and sugar. Opium is also a noteworthy article of import.

Ports.—The district has 172 miles of seaboard, but the only port with any trade is Cocanada, and the anchorage is a considerable distance from the shore. Bandarmalanka and Upada are sub-ports.

Communications.—Steamships.—The British India Company have a regular weekly service of steamers from Rangoon, touching at Cocanada and intermediate ports, but as many as six or seven steamers of this line call weekly. The Asiatic Steam Navigation Company and the Clan line have weekly steamers, and those of the Austrian Lloyd and of a Venetian company touch irregularly.

Railways.—The East Coast line of the Madras Railway enters the district about 10 miles westward of Ellore, and running along the fringe of the delta, crosses the Godavari river at Rajahmundry, on a steel girder bridge, over 1½ miles long, on masonry piers. From Cocanada a branch runs for 10 miles to Samalcot, and thence to Rajahmundry.

There are 918 miles of metalled roads, 814 miles being planted with avenues of trees.'

The canals, the most important means of communication in the district, have been mentioned with Godavari river, on which latter there are ferry steamers.

Climate.—The district is generally healthy, but fever is very prevalent, especially during the cold season, and this is particularly the case in the agency tracts, where it is of a virulent type in some parts: beri-beri is common along the coast.

The mean temperature at Rajahmundry averages 82°, with a mean range of 18°, but the humidity of the atmosphere renders the heat oppressive. The average rainfall is 33 inches, two-thirds of which falls during the South-west monsoon, setting in about the middle of June, with practically no rain in the first four months of the year.

Chart 829, Cocanada to Bassein river.

VIZAGAPATAM, the district lying next north-eastward of Godavari, and bounded on its north-east side by Ganjam district, is the largest in the presidency, and one of the largest in India: it lies between the parallels of 17° 15′ and 20° 7′ N., and the meridians of 81° 24′ and 84° 3′ E., and has an area of 17,222 square miles.

Chart 829, Cocanada to Bassein river.

The district has apparently passed through the hands of the Andhras, the Pallavas, the Cholas, and was over-run by the Mohammedan armies about 1480. A factory of the East India Company was founded in the middle of the seventeenth century, but in 1757 fell into the hands of the French, and again in 1794 into British power, and the present district was formed of three collectorates in 1802. Here there is also an agency tract, which includes 12,622 square miles.

Physical features.—The district is for the most part hilly and picturesque, especially in the north, but in the south there is a cultivated plain, divided from the hilly part by a portion of the Eastern Ghâts, which, passing from south-west to north-east through the district, average from 2,000 to 3,000 feet in height forming the main watershed.

Rivers.—Owing to this main watershed passing through the centre of the district, the rivers are usually short, and those falling into the Bay of Bengal, are irregular in flow and of no importance for irrigation or navigation.

Geology.—The fundamental rocks are gneisses and igneous rocks of the Archæan group, which outcrop mainly in lines running north-east and south-west; the surface rocks include pisolitic laterite, containing a considerable amount of hydrated alumina, which will probably become valuable as an ore of aluminium. Other recent deposits include the alluvium of the plains and older red laterite loam.

Flora and fauna.—The flora varies with the variations of altitude and moisture which occur; salt-water plants being found along the shore, the ordinary trees and plants of the east coast on the plains further west, and the flora characteristic of the moist regions of the presidency on the hills.

The wild animals, usual in South Indian forests, are abundant in the hilly country, and especially in the more remote parts, which are considered to be the best game tracts left in Madras, but only special notice is necessary in the case of the wild buffalo (*Bos bubalus*) found in some parts of the district, and nowhere else in the presidency.

Population.—The district contains 12 towns and over 12,000 villages, the greater number being small, and in 1901 the population was 2,933,650, of which 99 per cent. were Hindus, the proportion of Mohammedans and Christians being smaller than any other district, except Ganjam. Telugu is the language of the plains, but in the hill country the greatest confusion of tongues prevails.

Products.—A peculiarity of the district is the multiplicity of its crops and harvests, as with the exception of about two months, from March to May, cultivation and harvesting are continually going on. Rice, cambu, ragi, and pulses are grown, and of the industrial crops are gingelly, sugar cane, cotton, tobacco, and indigo. Cattle are small, and goats and sheep are chiefly kept for their manure. Workable iron ores exist, but are only smelted for local use, and manganese ore is the only mineral extracted to any extent.

There are no arts nor manufactures of any importance, but weaving common cloth goes on in nearly every village; there is a distillery, which manufactures country spirits, and also a jute factory.

Trade.—The exports are chiefly manganese ore, hides and skins, grain, and raw sugar; and imports, cotton piece goods, twist and yarn, hardware, iron, and timber.

Ports.—The two principal ports are Vizagapatam and Bimlipatam.

Communication.—Steamships.—The British India Steam Navigation Company have a weekly service of steam vessels to Vizagapatam and Bimlipatam.

Railways.—The East Coast Railway runs along the coast from south-west to north-east, for a distance of 137 miles, with a short branch to Vizagapatam. From the town of Vizagapatam a line is in course of construction to Raipur, in the central provinces, passing through Paravatipuram.

There are nearly 1,000 miles of roads, of which 370 miles are metalled, and 537 are planted with avenues of trees.

Climate.—The climate is moist and relaxing along the coast, hotter and drier inland, and wettest and coldest in the hills, and the most prevalent disease is malarial fever, which differs in intensity according to the locality, being of a comparatively mild type on the plains; beri-beri and elephantiasis are common chiefly on the coast.

The rainfall, principally during the South-west monsoon, is heaviest north of the Ghâts, in Jeypore, and lightest along the coast, the average at the former being 66 inches and at the latter 38 inches, with an average of 43 on the plains; the yearly mean temperature of Vizagapatam town is 82°, the climate being pleasant in the cold season, although somewhat relaxing at other times.

GANJAM, the northernmost district of the Madras presidency, is triangular in shape the apex being at its southern end; it lies between the parallels of 18° 12′ and 20° 26′ N., and the meridians of 83° 30′ and 85° 12′ E., and has an area of 8,372 square miles.

Conquered by the Asokas in 260 B.C., it passed a little later to the Andhras, who were driven out in the third century to make room for the Gangas, who were succeeded by the Cholas about the end of the tenth century, and for nearly 200 years after 1571, the country was ruled by Mohammedans, till, in 1757, the French obtained some tracts of land, which were captured by the British in 1759. In the early part of the eighteenth century the district was much disturbed, but in

Chart 829, Cocanada to Bassein river.

1836 it was quieted down, and no disturbances of any importance have taken place since.

Physical features.—A considerable portion of the district is mountainous and rocky, but it is interspersed with valleys and fertile plains, with pleasant groves of trees, which, with its background of wild hills, often covered with dark jungle renders it one of the most beautiful districts in the presidency.

The Eastern Gháts traverse it from south to north and are nowhere more than 50 miles from the sea, being only 15 miles at Baruva, in the centre of the district, and here Singarazu and Mahendragiri peaks, the two loftiest in the district, are nearly 5,000 feet; Devagiri, 4,535 feet, the next highest hill, is further south.

Rivers.—Three principal rivers all used for irrigation, flow into the bay, of which the Langulya is the southernmost, forming, for the last 30 miles of its course, the southern boundary of the district, and entering the sea 3 miles from Chicacole, where it is crossed by the trunk road on a fine bridge. The Vamsadhara, the next to the north, runs into the bay at Kalingapatam, and the Rushikulya drains the northern part of the district, discharging at Ganjam.

Geology.—The exposed rocks are Archaean gneisses and schists, with bands of granite formation, and at an elevation of 4,000 feet are capped with horizontal laterite, while in the flat coast region, except where there are rocky ridges and hills, recent alluvium and laterite red clay are generally present.

Flora and fauna.—Scrub jungle covers a large extent of the wooded area near the coast, with tree forest farther inland, and the herbaceous flora is made up of plants belonging to both dry and moist regions; the most characteristic forest tree is sal (*Shorea robusta*), and in some places along the coast casuarina has been planted.

Bears and hyenas are common, and wolves, leopards, and tigers are also met with; sambar, spotted deer, barking deer, and moose occur on the slopes of the hills, and antelopes are found in the plains; wild dogs are abundant.

Population.—The district contains eight towns and over 6,000 villages, most of the latter small; in 1901 the population was 2,010,256, with fewer Mussulmen and Christians than any of the other districts of the presidency. Telugu is mainly spoken in the southern, and Oriya in the northern portion of the district.

Products.—Rice is the most important crop, covering nearly three-fourths of the cultivated area, with ragi next, covering one-sixth; other important crops are green gram, horse gram, and gingelly, and the products of the forest areas are alum, arrowroot, myrabolams, gall nuts, and oranges, while mango trees are scattered around the villages. Bullocks and buffaloes, bred locally, are inferior and under-sized animals.

There is a sugar factory and a distillery for country spirits, a tannery, and a salt factory; sea and river fisheries constitute an important industry. There are no mines, but manganese ore has been found in small quantities, also mica, antimony, ore, and corundum.

Trade.—The principal exports are grain, pulses, myrabolams, hides and skins, oilseeds, turmeric, wood, salt, salted fish, and cocoanuts. The imports are mainly rice, piece goods, twist, glassware, metals and metal goods, kerosene oil, spices, and gunny bags.

Ports.—The three ports are Kalingapatam, Baruva, and Gopalpur, the first and last being open to foreign as well as coasting trade.

Communication.—Steamships.—The British India Steam Navigation Company have a weekly service of steam vessels to the above ports.

Railways.—The East Coast section of the Bengal-Nagpur Railway runs through the district, nearly parallel to the coast, with a branch at Naupada to the estates of the Raja of Parlakimedi.

Of a total of 729 miles of metalled roads, 650 miles are planted with avenues of trees.

Climate.—With the exception of Ganjam town, which is exceedingly malarious, the coast climate is usually cool and healthy, and the district is one of the few in the presidency which enjoys a really cold season.

The rainfall is usually considerable, and that in the South-west monsoon is heavier inland than on the coast, while the reverse is the case in the North-east monsoon; in both monsoons it is heavier in the northern part than in the southern part. The fall for the whole district averages 45 inches, and for the agency 55 inches.

BENGAL, formerly the largest and most populous province in India, with an area of nearly 190,000 square miles, has recently undergone changes in its constitution, and now comprises an area of 148,592 square miles; the divisions on the sea coast, from west to east, are respectively Orissa, Burdwan, and the Presidency division.

As the early history of the province is somewhat complicated, it seems sufficient to mention that the Portuguese in 1530, were probably the first European traders, the Dutch settled in some parts in 1625, and the first East India Company's factory was established near Balasore in 1642. The French established themselves at Chandernagore in 1688, and this was captured by the British, but afterwards restored. In 1756 the Nawab of Bengal took Calcutta, and the Black Hole massacre occurred, followed by Clive's victory in 1757, since which various changes have taken place in the constitution and government of the province. It was placed under a Lieutenant-Governor in 1854, who is assisted by a Legislative Council.

Physical features.—The main axis of the Himalayas, near the northern frontier of the province, has some of the highest peaks in the world, as Mount Everest (29,002), Mount Kinchinjunga (28,150), Mount Devalagiri (26,826), and others of as nearly as great altitude. From Mount Kinchinjunga the Singalila range extends to the southward, forming the boundary between Nepal and Darjeeling, the peak of the same name as the range being 12,130 feet above high water.

The most distinctive feature of the district is its network of rivers, which, with their affluents and distributaries, afford means of communication, and are useful for irrigation purposes, and for their supply of fish.

The Ganges, rising from an ice cave at the foot of the Himalayas, at an altitude of 13,800 feet, has a general easterly course from the western frontier of the district, with various changes in direction, as far as Rajmahal, and in this part receives the following tributaries, viz.:—the Gogra, the Son, the Gandak, and the Kosi. From the Rajmahal hills it turns sharply to the southward, and about 20 miles further on commences to branch out over the level country, being here about 300 miles, by its windings, from the Bay if Bengal.

The Húgli is its westernmost and most important mouth for the purposes of navigation, and on it stands the city of Calcutta; the Meghna is the easternmost mouth, and among the number of others between may be mentioned the Matla, Raimangal, Malancha, and Haringhata; between the Húgli and the Meghna is the Ganges delta.

There are services of steam vessels along its whole course within Bengal, and, of the many towns lying on its banks, Patna and Monghyr are the most important.

The Brahmaputra, having its source at no great distance from the Ganges, but on the other side of the Himalayas, joins the Meghna, and discharges by that mouth.

Geology, &c.—The geology, flora, fauna, &c., of that portion of Bengal which borders the sea coast, will be described with the various districts.

Population.—The population, as now constituted, is 50,722,067, of which nearly 78 per cent, are Hindus, and only about 5 per cent. live in towns. The principal languages are Bengali and Hindustani.

Products.—The chief products of the province are rice, opium, indigo, oilseeds, sugar, tobacco, silk, tea, and jute, and in the hills bordering the great plain are coal measures yielding the greater part of India's coal output.

Chart 829, Cocanada to Bassein river.

DISTRICTS.—The districts of Bengal on the coast are Puri, Cuttack, Balasore, Midnapore, and twenty-four Parganas and Khulna, the last two including the Sundarbans or Ganges delta.

PURI, the southernmost district of the Orissa Division of Bengal, is triangular in shape, lies between the parallels of 19° 28′ and 20° 26′ N., and the meridians of 84° 56′ and 86° 25′ E., and has an area of 2,472 square miles; it joins Ganjam on the west, and is bounded on the east by Cuttack district.

Since this district passed to the British, in 1804, the only noteworthy political events in connection with it are the rebellion of the Raja of Khurda, in 1804, and the rising of the paiks, or landed militia, in 1817.

Physical features.—The district may be divided into three tracts, viz.:—the western, central, and eastern. In the first is Chilka lake, about 35 miles in length, and on its northern side are spurs from the hills further north, extending to its shore, with fertile valleys between them. The middle and eastern tracts consist entirely of alluvial plains, watered by a network of channels.

The coastline is a belt of sandy ridges, varying from a few hundred yards to about 4 miles in breadth, and in the eastern part is Sar lake, a backwater of the Bhargavi river.

Rivers.—The most important rivers are the Nun, the Daya, and the Bhargavi, all entering Chilka lake; they are mostly shallow in the dry season, but come down very heavily during the rains. The Kushbhadra, the only river entering the sea, has a very winding course and is of little value for navigation.

Geology.—The hills are composed of compact gneiss, or garnetiferous rock, with bands of quartzose gneiss with a raised terrace-like plain of laterite round them, which also probably underlies the recent alluvium of the eastern part of the district. A bed of mud with estuarine shells is found on the southern shore of Chilka lake.

Flora and fauna.—The red cotton tree, some palms and Tamarindus indica grow near villages; mangroves cover banks of rivers and creeks, and ponds and ditches have water weeds or submerged water plants.

Small game is plentiful, but in the open part of the country large animals are nearly extinct.

Population.—The population numbered 1,017,284 in 1901, of which more than 98 per cent. were Hindus, and the remainder Mohammedans; the language generally spoken is Oriya.

Products.—Rice and pulses are the chief crops, and castor oil, sugar cane, cotton, indigo, tobacco, and vegetables are also grown. Cattle are reared.

Chart 829, Cocanada to Bassein river.

Laterite, lime, and sandstone are found, but no quarries are worked.

Cotton cloth, brass and bell-metal utensils, brass, gold, and silver ornaments, and wickerwork baskets are manufactured.

Trade.—The chief exports are rice, gram, pulse, unrefined sugar, cocoanuts, brass, and silk, and imports raw cotton, piece goods, refined sugar, spices, nuts, iron, tobacco, kerosene oil, salt, copper.

Ports.—Puri is the port and only town.

Communication.—Steamships.—The steamers of the British India Steam Navigation Company, running between Cocanada and Rangoon, call at Puri if there is an inducement to do so.

Railways.—The East Coast section of the Bengal-Nagpur Railway passes from south-west to north-east through the whole district, with a branch, 28 miles long, connecting Puri and Khurda. The district is also well supplied with roads.

Climate.—Although directly on the track of the cycloidal storms, experienced frequently during the monsoon season, the sea breezes usually maintain an equable climate in the district. The mean temperature, which is 86° in the hot months, falls to 84° in the monsoon season, and to 77° in February, the average maximum temperature being 89° in April and May. The annual rainfall averages 58 inches, of which about 42 inches falls between June and September, both inclusive. The humidity ranges from 75 per cent. in December to 86 per cent. in August.

Cholera is imported annually by pilgrims; fever is prevalent during the cold season, and small-pox occasionally appears in a virulent form.

CUTTACK, the district lying next north-eastward of Puri, is between the parallels of 20° 2′ and 21° 10′ N., and the meridians of 85° 20′ and 87° 1′ E., and has an area of 3,654 square miles; it has no separate history.

Physical features.—It consists of three distinct tracts, that along the sea coast being a marshy, jungle-covered strip, from 3 to 30 miles in breadth, with behind it an arable tract of rice land, and then a broken, hilly region along its western boundary. The strip first mentioned is intersected by innumerable streams and creeks, and the arable plain by the large rivers which flow from the western mountains. A few isolated hills stand in the plains, the chief being Naltigiri, Udayagiri, and Assia, the second having a colossal image of Buddha, and the last 2,500 feet high, the highest point in the district.

Rivers.—The most conspicuous feature of the district is its rivers, of which the Mahanadi, or Great river, after many interlacings, forms two great estuaries, the Devi, the western, entering the Bay of Bengal at the south part of the district, and the Mahanadi, the eastern, near False point.

The Baitarani and the Brahmani, meeting before they reach the sea, flow into the bay at Palmyras point, as the Dhamra. The chief offshoots of the Mahanadi are the Katjuri, Paiki, Birupa, and Chitartala, and the Kharsua is an important tributary of the Brahmani.

Canals.—The greater part of the Orissa canal system lies within the limits of this district, and consists of the following canals, with their respective lengths:—The Machgaon, 32 miles; the Taldanda, 52 miles; the Kendrapara, 39 miles; the Gobri, 15 miles; the Patamundal, 47 miles; the High Level canal, 45½ miles; and the Jaipur, 6½ miles.

Geology.—South of the Brahmani river are numerous gneissic hills, the gneiss for some miles being compact, but further south assuming a more or less decomposed form, which, being easy to work, is occasionally quarried. The plain to the south is covered with laterite, with gneiss at intervals, and the hills near the Mahanadi are formed of coarse grits, sandstones, and conglomerates.

Flora and fauna.—The flora is somewhat similar to that of Puri.

Tigers, bears, leopards, wild buffaloes, antelopes, spotted deer, hyenas, jackals, foxes, and wild hogs are found. Fish-eating and man-eating crocodiles, growing to a very large size, abound in all the rivers and creeks.

Population.—In 1901 the population was 2,062,758, of which 97 per cent. were Hindus; the language of the district is Oriya.

Products.—Rice is the principal grain cultivated, and pulses, oilseeds, sugar cane, tobacco, potatoes, and betel leaf are also grown; cattle and sheep are bred. Cotton weaving is extensively carried on; the silver filigree work is well known, and other manufactures are bell-metal work, lac and brass ornaments, pottery, hardware, gunny bags, baskets, &c.

Trade.—The chief exports are rice, oil-seeds, hides, jute, timber, horns, lac, nux vomica, beeswax, resin, and silver filigree work. The principal imports consist of piece goods, kerosene oil, crockery, glassware, fancy goods, metals, yarn, betel nuts, and spices.

Ports.—False point is the principal port.

Communication.—**Steamships.**—Steam vessels ply three times every week from Cuttack city to Chandbali by canal, and from Chandbali to Calcutta by sea; cargo steamers call irregularly at False point.

Chart 829, Cocanada to Bassein river.

Railways.—The Cuttack-Midnapore extension of the Bengal-Nagpur railway runs from south-west to north-east through the district. Of about 800 miles of roads, over 700 miles are unmetalled.

Climate.—The extremes of climate are more marked than in any other part of Bengal, and cyclonic storms frequently cross the district, which lies directly in their track. The mean temperature falls from 88° in the hot months to 83° in the monsoon, and to 69° in February; the average maximum temperature in April and May is 102°. Of the annual rainfall, which averages 60 inches, about 55 inches falls between May and October, each inclusive.

The district is especially liable to small-pox.

BALASORE, the northern district of Orissa, is situated between the parallels of 20° 44′ and 21° 57′ N., and the meridians of 86° 16′ and 87° 31′ E., and has an area of 2,085 square miles. Its early history presents no special feature of interest; although a factory was established in 1633, the district did not become British property until 1803.

Physical features.—The district consists of a strip of alluvial land lying between the sea and the hills which rise from the western boundary, and which has a breadth of about 40 miles in the south, 10 miles in the middle, and 30 miles at its north-east extreme.

Rivers.—The Baitarani, forming the boundary between Cuttack and Balasore, and which, after its junction with the Brahmani, is named the Dhamra, is navigable as far as Olokh, about 15 miles from its mouth, after which it is not tidal, and can be forded in the hot season.

The Kansbans, subject to sudden freshes, discharges by two mouths, the southern named the Gammai (Gamai).

The Burhabalang, on which is Balasore town, has a tortuous course of 35 miles, 21 miles of which is tidal, and, although barred at its mouth, admits small vessels which reach the town.

The Panchpara Nud is tidal for 10 miles, and in some parts is navigable for large boats.

The Subarnarekha, the northern river, has a course of 60 miles in the district, and communicates with the coast canal at Jamkunda lock; it is largely used by Calcutta country boats.

Geology.—The Nilgiri hills consist of granitoid gneiss, and bands of a chloritic rock, approaching serpentine in texture, and along the base of the hills laterite occurs. In the south-west part quartz schist comes in.

Flora and fauna.—Red cotton trees, tamarindus indica, banyans, and palms are grown near villages, and open glades are filled with grasses, sometimes reedy; sedges abound, and ferns are fairly plentiful.

Black bears are found in the north, and tigers, leopards, hyenas, spotted deer, antelopes, hogdeer, mouse, civet cats, and hares are common in the more jungle portions.

Population.—In 1901 the population was 1,071,197, of which about 96 per cent. were Hindus; Oriya is the language spoken.

Products.—Rice is the great crop, as pulses and oilseeds, also grown, are of minor importance. The cattle reared are similar to those common in South Bengal.

Cotton weaving and mat making are carried on, and brass and bell-metal articles are manufactured. Laterite, found in the western part of the district, is used for building purposes.

Trade.—The exports are rice, hides, jute, oilseeds, timber, and stoneware, and imports European cotton piece goods, oil, salt, and spices.

Ports.—The ports are Chandbali and Balasore.

Communication.—**Steamships.**—Chandbali has communication by steamers four times weekly, and Balasore once every week, with Calcutta by those of the Indian General Steam Navigation Company.

Railways.—The Bengal-Nagpur Railway runs for 88 miles through the district connecting it with Calcutta, Cuttack, and Madras, and from Rupsa junction there is a branch line to Baripada. A coast railway, connecting Chandbali and Balasore, is contemplated, also a light railway from Balasore to the Nilgiri stone quarries.

Climate.—The extremes of climate are the same as those mentioned for Cuttack. The mean temperature falls from 89° in the hot months to 83° in the monsoon, and to 74° in February, the average maximum in April and May being 98°. The average rainfall is 60 inches, of which 55 inches falls between May and October, both months inclusive. The humidity ranges from 79 per cent. in April and May to 80 per cent. in August.

The district suffers from severe epidemics of cholera; elephantiasis is extremely common, and fever prevails in the cold season, but the country is singularly free from malaria, except in one part.

BURDWAN has been already mentioned as one of the divisions of Bengal.

MIDNAPORE (Midnapur), the southern district of Burdwan, lies between the parallels of 21° 36′ and 22° 57′ N., and the meridians of 86° 33′ and 88° 11′ E., has an area of 5,186 square miles, and is the most populous of the Bengal Regulation Districts. The district came under Buddhist influence early in the fifth century, and the

Chart 829, Cocanada to Bassein river.

British occupation dates from 1760, the chiefs of the hill country giving considerable trouble during the early years of administration.

Physical features.—It contains three tracts of well-marked character: the north and west of laterite formation, the east deltaic, and the south seaboard, and the greater part of the district is generally level, but in the north-west are several hills over 1,000 feet high; all the eastern part is deltaic.

Rivers.—The chief rivers are the Húgli and its three tidal tributaries, the Rásulpur, the Huldia, and the Rupnarayan. Húgli river, the westernmost, and, for commercial purposes, the most important, channel which discharges the waters of the Ganges, is formed by the confluence of three streams, the Bhagirathi, the Jalangi, and the Matabhanga, which are collectively known as the Nadia rivers.

From near the vicinity of Nadia town, it receives its name of Húgli, and it may be divided into two sections, the first from Sagar island, where is the estuary, to Calcutta, a distance of about 80 miles, the second section being from Calcutta to Santipur, a distance of 64 miles.

On its right bank it receives four tributaries, the Damodar joining it 35 miles below Calcutta, and the remaining three which have been already mentioned. It is tidal as far as Nadia, especially during the dry season, when the tidal inflow of four months is said to be more than double the fresh-water discharge of the year.

Below Calcutta the changes in the channel are frequent, and this, combined with the tidal streams, makes navigation difficult, and in the estuary are several dangerous sandbanks, continually changing, but certain parts of the river are sounded daily, and the result telegraphed to Diamond harbour and Calcutta, for the information of inward and outward bound vessels.

Canals.—The Coast canal, from Geonkhali at the junction of the Rupnarayan and Húgli rivers, runs to the Huldia and Rásulpur rivers, and then to Kontai, and thence into the Balasore district; it is used for navigation.

Geology.—A low ridge in the north-west part, is formed of micacean schists, but the plains there are covered with laterite rocks, which gradually give way, in the south and east, to the ordinary alluvium of the Ganges delta.

Flora and fauna.—Some species of figs, as the pipal and the banyan, with red cotton and other trees, are found in the vicinity of the villages, where palmyra palms are also present. Aquatic plants cover ponds and ditches, and climbing creepers and various milkweeds are found in waste places and on hedges.

Bears and deer are still common in the west, and leopards and hyenas are not uncommon; there are a few wild elephants and wolves, and an occasional tiger may be met with. Small game, including wild geese, ducks, ortolans, teal, and hares, is plentiful, and snakes are numerous.

Population.—The population numbered 2,789,114 in 1901, of which about 88 per cent. were Hindus; Bengali is the principal language, but nearly 10 per cent. of the population speak Oriya.

Products.—Abundant rice crops are grown in the south and east, and other crops are wheat, barley, peas, linseed, mustard, sesamum, sugar cane, mulberry, jute, cotton, and indigo. Cattle are poor, and buffaloes are commonly kept for milk in the south. Jungle products are lac, tasar silk, wax, wood dye, bark fabrics, resin, firewood, and charcoal.

Excellent mats are manufactured; pottery is made, as also brass, copper, and bell-metal ware.

Trade.—The chief exports are rice, sugar, molasses, jute, linseed, gram, pulses, charcoal, brass and metal ware, timber, hides, mats, silk and cotton cloth, tasar silk, pottery, and vegetables. The imports are cotton goods, coal and coke, kerosene, gunny bags, salt, tobacco, potatoes, nails, &c.

Communication.—**Steamships.**—The principal lines which have a regular service to Calcutta are the Peninsular and Oriental, British India, and Messageries Maritimes, but steam vessels of several other companies visit the port regularly, and there are a number of lines of coasting and river steamers.

Railways.—The main line of the Bengal-Nagpur Railway, from Bombay to Calcutta, traverses the district from west to east, with branches to the south and north, at Kharakpur.

Climate.—The climate differs between the arid north and west, and the swampy south and east, portions, but the average mean temperature for the whole district is 80°, it being wetter and cooler near the coastline. In the north and west, exceptionally high day temperatures are experienced in the hot months, and the mean maximum rises to 102° in April and May. The total rainfall averages 59 inches, of which 49 inches falls from June to October, both months inclusive.

The district is fairly healthy, with malaria in some of the low-lying tracts and in its centre; cholera has considerably diminished, hepatitis is common, and elephantiasis exists in the swampy parts.

SUNDARBANS is the name given to a vast tract of forest and swamp extending for about 170 miles from the estuary of the Húgli to that of the Meghna, and stretching inland to distances of from 60 to 80 miles; it lies between the parallels of 21° 31′ and 22° 38′ N. and the meridians of 88° 5′ and 90° 28′ E., has an area of 6,526 square

Chart 829, Cocanada to Bassein river.

miles, and includes the districts of twenty-four Parganas, Khulna, and Backergunge, the latter in Eastern Bengal.

Originally Mohammedan, in the fifteenth century, the Sundarbans are believed to have been more extensively populated, but it is supposed that piracy was the cause of depopulation.

Rivers.—Forming the lower part of the Ganges delta, it is intersected from north to south by the estuaries of that river, the most important being the Húgli, Matla, Raimangal, Malancha, Haringhata, Rabnabad, and Meghna, which are connected with each other by an intricate series of branches, enclosing a large number of islands of various sizes and shapes.

Flora and fauna.—Mangroves, which almost entirely cover that part near the sea, gradually get thinner inland, and towards the north there are forests, in which the most plentiful and important species is sundri, with rather dense undergrowth; forests also cover the flat, swampy islands.

Tigers are destructive; the rhinoceros is nearly extinct; buffaloes, hogs, spotted deer, barking deer, and hog deer are found. The rivers are infested with crocodiles, dangerous to man and beast, and the cobra, the python, and many varieties of snakes are met with. In the cold season wild geese, ducks, and other birds are numerous on the sandbanks.

Population.—The population is somewhat floating, as between the months of October and May crowds of woodcutters come for the purpose of cutting jungle. There are no towns or villages, and the inhabitants are scattered in small hamlets.

Products.—Rice is grown on reclaimed land in the north, and sugar cane and areca nuts are cultivated; country knives, buffalo-horn combs, and pottery are made.

Trade.—Rice, betel nuts, and black clay pottery are exported.

Ports.—Canning, on the Matla river, is the only port.

Communication.—Steamships.—A system of artificial canals connects the tidal creeks and channels of the Sundarbans, and regular lines of steam vessels use these, while country boats have access to almost every part.

Railways.—Canning is connected with Calcutta by rail.

Telegraph.—Fraserganj, at the mouth of the Húgli, has been selected as a permanent wireless telegraph station.

Climate.—The average rainfall varies from about 82 inches in the west to 200 inches in the east, and cyclones and storm waves occur from time to time.

EASTERN BENGAL.—CHITTAGONG, the southernmost district of Eastern Bengal, lying between the parallels of 20° 35′

and 22° 59′ N. and the meridians of 91° 27′ and 92° 22′ E., has an area of 2,492 square miles, and a sea coast of 166 miles, from the Fenny river to St. Martins island.

Prior to its conquest by the Mohammedans, in the fourteenth century, it frequently changed hands, and from the sixteenth century the Portuguese had a great interest in the district. From 1686 to 1689 British expeditions were sent against it, and in 1760 it was ceded to the East India Company. In 1786 the French endeavoured to establish a claim to certain parts. During the Indian Mutiny a native regiment at Chittagong joined the mutineers, and later the hill tribes gave trouble, but since 1892 the district has been quiet.

Physical features.—The district consists of a long, narrow strip of coast, with three low ranges of hills, parallel to each other and the coast, with valleys between.

Rivers.—The Fenny, which forms the western boundary, is only navigable for large boats for a distance of about 30 miles.

The Karnaphuli, the most important river, has a west and southwest direction, and enters the bay 10½ miles from the town of Chittagong, for which distance it is navigable for seagoing vessels, and for light-draught steam vessels as far as Rangamati; native cargo boats can go to Kasalang, 96 miles from its mouth, and during the rains river steamers can ascend to Barkal rapids, 14 miles higher.

The Sangu river, which enters the bay about 10 miles south of the Karnaphuli, has a course of 168 miles; it is tidal as far as Bandarban, and is navigable for large cargo boats for a distance of 30 miles throughout the year.

The Mamori (Matamuhari) has a course of 96 miles, and discharges through a broad delta, somewhat resembling the Sundarbans, to the eastward of Kutubdia island; it is navigable, through its extensive delta for the largest boats.

Geology.—This district appears to consist of a substratum of tertiary rocks, covered to a considerable extent by alluvial deposits, the hills being generally capped with laterite.

Flora and fauna.—The forests contain valuable timber, and what is known as Chittagong wood or Indian mahogany, besides species of oak, elm, and a chestnut, are found amongst several kinds of handsome trees. Canes and bamboos are luxuriant; ferns and orchids grow everywhere, and the vegetation is that of a moist tropical climate.

Tigers, black and clouded leopards, are found; bears are rare; elephants are destructive in the southern part, and wild cattle do damage to crops. Amongst other mammals are monkeys, the Indian fox, the jackal, the hog badger, the marten, the otter, and the scaly ant eater and squirrels; rats and mice are numerous.

Chart 829, Cocanada to Bassein river.

The birds include vultures, falcons, eagles, hawks, kites, owls, swallows, and swifts. There are hornbills, broadbills, many varieties of flycatchers, pheasants, jungle fowl, geese, ducks, teal, and other birds too numerous to mention. All sea snakes are venomous, and of land snakes are the great hamadryad, the python, and green rattlesnake, but cobras are not common. Fish are especially numerous, and the best eating species is named rupchanda.

Population.—In 1901 the population was 1,353,250.

Products.—Rice is the most important crop, and hemp, tobacco, mustard, lentils, melons, and vegetables are grown; oil seeds, chillies, sugar cane, and betel are also cultivated.

Cattle are very poor; buffaloes are the most valuable domestic animals, and ponies and sheep are reared in small numbers.

Boatbuilding, weaving, and some metalwork are carried on, and there are two small pearl fisheries.

Trade.—Tea, jute, and rice are the principal exports, and the chief imports are corrugated iron, salt, cotton piece goods, sugar, and oil.

Ports.—The ports are Chittagong, Cox's Bazar, and Nhila, the latter only used for the shipment of rice.

Communication. — Steamships. — There are services of coasting steamers belonging to the British India Steam Navigation Company and the Asiatic Steam Navigation Company, and the Bengal Steam Navigation Company has recently started steam vessels between Chittagong and Burmese ports.

Two steamers run between Chittagong and Cox's Bazar; a weekly steamer plys to Rangamati, and a regular steamer service exists between Chittagong and Noakhali and Barisal.

Railways.—The Assam-Bengal Railway crosses the Fenny river from Noakhali, and runs for nearly 50 miles through the district to Chittagong, which is the terminus.

Canals.—The Boalkhali canal connects the Karnaphuli and Sangu rivers; the Banskhali canal joins the Sangu river to the Kutubdia channel and the Murari canal, between the river of the same name and the Sikalbhanga river, shortens the journey from Chittagong to the Sangu river.

There are 541 miles of roads, all unmetalled.

Climate.—The district, forming a comparatively narrow belt lying along the sea coast, is favourably situated for both land and sea breezes, and the uniformity of temperature is more marked than in other parts of India; the climate is therefore moist, warm, and equable. The average maximum temperature is about 87° in December and January, and 98·7°, in June, while the minimum is 45·4° in January, and 69·8° in August; during the monsoon season the mean temperature varies from 80° to 82°. The highest temperature registered in Chittagong is 101°, and the minimum 45°.

The average rainfall for the whole district is 111 inches, but it varies considerably from place to place, as at Cox's Bazar it is 140 inches, at Chittagong 105 inches, and at Kodala 96 inches. The humidity is lowest in January and February, and does not reach its maximum till September; during the whole monsoon season it varies from 80 to 91 per cent.

Owing to the number of waterways connecting the tidal river, and the innumerable tanks, neither of which are clean, and form breeding places for mosquitoes, malarial fever is very prevalent, and cholera occasionally breaks out in a virulent epidemic form; the other most prevalent diseases are those of the skin and ear and intestinal worms.

BURMA, which stretches along the western edge of that portion of the continent of Asia lying between the Bay of Bengal and the China sea, and generally known as Indo-China, is situated between the parallels of 9° 58′ and 27° 20′ N. and the meridians of 92° 11′ and 101° 9′ E., and has an area of 237,000 square miles; it is the largest province of the Indian Empire.

Prior to 1852 British dominion was represented by the provinces of Arakan and Tenasserim, but in that year the southern portions of the main central section were added, and thirty-four years after Upper Burma was annexed. In this work it is only necessary to mention those divisions which border the sea coast, which are Arakan, Irrawaddy, Pegu, and Tenasserim.

Arakan Yoma, or Yoma mountains, the most southerly spur thrown out from the mass of hill country, stretching north and south along the western edge of Burma, is a well-defined narrow ridge, from 4,000 to 5,000 feet at its highest point, steep, and thickly wooded. There are two principal passes over the ridge, one from An, in the Kyaukpyu, and the other from Taungup, in the Sandoway district; the inhabitants of the Yomas are almost exclusively Chinese.

Uniform time.—Standard time of the meridian of 97° 30′ 0″ E., or 5h. 30m. 0s. fast of Greenwich mean time, is kept.

AKYAB, the northern coast district of Arakan division, which joins Chittagong on its north-west side, lies between the parallels of 19° 47′ and 21° 27′ N. and the meridians of 92° 11′ and 93° 58′ E., and has an area of 5,136 square miles.

It formed part of the kingdom of Arakan, and became a British possession in 1826, at the termination of the Burmese war.

Chart 829, Cocanada to Bassein river.

Physical features.—A level tract lies between the sea and the Yoma mountains, with broken country formed by the western spurs of that range, and valleys which cover the portion east of the Lemro river. The northern part is also covered with hills, and in the west, between the Naaf and Mayu rivers, is the steep Mayu range, terminating near the mouth of the river of that name; two similar ranges are also parallel to the coast, about 30 miles from Akyab town.

Rivers.—The rivers generally flow from north to south, and the principal are the Mayu, the Kaladan, and the Lemro, which at first are only mountain torrents, but in the plains spread out into a network of tidal channels.

The Kaladan is the largest and most important of these, and receives a large number of tributaries in its course, which is nearly due south through the Akyab district, to its estuary at Akyab town, where it is 6 miles broad and forms the harbour.

Geology.—Beyond the alluvium, which skirts the coast, the district contains cretaceous, lower tertiary, and triassic beds, closely allied, and composed of sandstones and shales, interspersed by bands of limestone.

Flora and fauna.—The coasts and tidal creeks are bordered by mangroves and dani palms, and, in addition to the trees of the tidal forests, the forest trees include *kabaung*, *pyingado*, *thitkado*, and *thitka*, but there are no teak trees. Further eastward the Arakan hills are covered with dense forest and bamboo jungle, at present unexplored by botanists.

Elephants, bison, tigers, and leopards are the most important wild animals; sambar are plentiful on the hillsides, and hogdeer in the low-lying jungle; wild hogs abound, and the jackal is found everywhere.

Population.—In 1901 the population was 481,666, of which about two-thirds were Buddhists and one-third Mussulmen.

Products.—Rice is the principal crop, chillies, mustard, and the dani palm for thatching are also grown; cotton, tobacco, sugar cane, and flax are cultivated in small quantities. A superior breed of buffaloes are raised, goats are reared in numbers, but sheep are not bred.

Coal of an inferior quality has been found, and gold and silver are said to exist. Oil wells are worked on Baronga island.

The chief industries are cotton and silk weaving, gold and silver work, carpentry, shoemaking, pottery, and ironwork.

Ports.—Akyab is the principal port.

Communication.—Steamships.—The British India Company's vessels call weekly at Akyab for Kyaukpyu, Sandoway (in the fine season), and Rangoon, and weekly for Chittagong and Calcutta.

Chart 829, Cocanada to Bassein river.
River steamers belonging to the Arakan Flotilla Company ply on all that part of the Kaladan river that lies within the district, and through the tidal creeks.

There are only 200 miles of roads, and of these only 40 miles are metalled; except in and near Akyab town, there is practically no vehicular traffic.

Climate.—Owing to the proximity of the sea, extremes of heat and cold are not experienced, and the cold season, from December to February, is the pleasantest, the hot season being oppressive and the wet season very trying. The average maximum temperature for the whole year is 86°, the average minimum 74°, and the average mean 78°.

The rainfall in 1903-4 was 180 inches, varying from 173 inches at Maungdaw to 203 inches at Akyab. *See* Meteorological table, Appendix, page 579.

KYAUKPYU, the next district south-eastward of Akyab, lies between the parallels of 18° 40′ and 20° 40′ N. and the meridians of 93° 13′ and 94° 26′ E., and has an area of 4,387 square miles. Previous to the conquest of Arakan by the Burmans in the eighteenth century, Kyaukpyu belonged to the Arakan kingdom, and for thirty years after the cession to the British, Ramree and Chedúba islands formed a separate district, afterwards becoming a part of Kyaukpyu.

Physical features.—It includes a strip of mainland extending from the western slopes of the Yoma mountains as far south as the Myhi (Mai) river, and, besides Ramree and Chedúba islands, a small archipelago of lesser islets lying along the coast, and separated from it by a number of tidal creeks and Hunters and Combermere bays.

Geology.—The rocks are partly cretaceous and partly eocene, and a particular feature of the Arakan coast is the number of mud volcanoes which occur, often taking the form of conical hillocks, discharging marsh gas and sometimes flames. *See* page 82.

Rivers.—There are no rivers of any importance; the Dalet and An are navigable for boats for distances of 25 and 45 miles respectively from their mouths, but above that are mountain torrents.

Flora and fauna.—*Pyingado* is the most valuable timber tree, forming compact masses of forest along the lower hills and the adjoining plains, and also on the hills of Ramree island, where *thitya, pyinma,* and *shawtu* also grow; *kanyinbyu, kokko,* and *pyinma* are much used for boatbuilding.

The forests abound with tigers, bears, deer, and wild hogs, and there are wild elephants in the mountains.

Population.—In 1901 the population was 168,827, principally Arakanese and Burmese, these also being the languages generally spoken.

Chart 829, Cocanada to Bassein river.

Products.—Rice, sugar cane, and tobacco are cultivated, and the dani palm is grown for thatching; a number of acres are under garden cultivation. Buffaloes, cattle, and a few goats are bred.

Two companies are extracting petroleum oil, of which more than 100,000 gallons are produced annually. Limestone is extracted from the hills, and coal has been found, but not worked, in both Ramree and Chedúba islands; there is also unworked iron in the former island. Salt is manufactured by evaporation. Mat weaving and pottery are the only other manufactures.

Trade.—The exports are rice, salt, timber, fish maws, hides, and horns, and the chief imports are hardware, foodstuff, cloth, waistcoats, cotton, and silk.

Ports.—The principal port is Kyaukpyu harbour, which is a large area of water extending for 30 miles between Ramree island and the mainland.

Communication.—Steamships.—Steamers of the British India Company call weekly at Kyaukpyu, in both directions, giving communication with Akyab, Sandoway, and Rangoon. Subsidised launches maintain weekly services to the head-quarters of the townships, and run also to Akyab and Sandoway.

Telegraph.—There is telegraphic communication.

Climate.—The climate is notoriously unhealthy; malarial fevers and bowel complaints are prevalent, the former at the beginning and the latter at the end of the rains, and the town itself is said to be situated in a very unhealthy area. The temperature varies little throughout the year, averaging 84° in 1900, when the maximum, registered in June, was 97°, and the minimum, in January, was 74°.

The rains, lasting from May to October, are heaviest in July, August, and September, and the annual rainfall for the years 1902-4 averaged 182 inches, being greatest at Ramree (203 inches) and least at An (161 inches).

SANDOWAY, the district which adjoins Kyaukpyu on its south-east side, is a narrow strip, 179 miles in length and 48 miles in extreme breadth; it lies between the parallels of 17° 15′ and 19° 52′ N. and the meridians of 94° 0′ and 94° 52′ E., and has an area of 3,784 square miles.

Supposed at one time to have been the capital of the Arakan kingdom, it was afterwards only a province till the conquest of Burma in 1784, when it became a governorship. It was ceded by treaty to Britain in 1826.

Physical features.—It is mountainous, the spurs of the Yoma mountains reaching almost to the coast, leaving not more than one-eighteenth of its area level. In the plains, and except where there are clearings on the hillsides, it is covered with dense jungle. In the northern part some of the peaks of the Yoma mountains attain an elevation of about 5,000 feet, but lower to the southward, and abreast the Gwa river the height is about 900 feet. Foul island, a mud volcano, which pours out mud and marsh gas, and lies off the coast, was in eruption in 1908.

Rivers.—Most of the rivers are but mountain torrents. The most important are the Myhi (Mai) and the Tanlwe, which fall into the arm of the sea dividing Ramree island from the mainland.

The Taungup enters near the village of that name, and the Sandoway, about 18 miles farther south, is tidal, and navigable for boats as far as Sandoway town; the Gwa discharges about 60 miles southward of the Sandoway.

Geology.—The rocks of the district are mostly cretaceous, those of the Myhi river being composed of limestones, shales, and greyish-green sandstone; the remainder are of the Eocene age.

Flora and fauna.—The lowest ground, within tidal influence, is covered with mangroves, but almost the whole of the remainder is clothed with forest, the trees varying with the altitude of the land. The most important are *pyingado, in, pyinma, kanyinbyu, thingan, zinbyun,* and the *myaukchaw;* various kinds of palms are common, especially the dani.

The fauna is varied, including elephants, tigers, leopards, wild cats, bears, wild hogs, deer, and monkeys. Jackals are common, as are crocodiles; the rhinoceros is found, and game birds are plentiful.

Population.—In 1901 the population was 90,927, of which 87 per cent. were Buddhists; Burmese and Arakanese are the languages spoken.

Products.—Rice, tobacco, and sesamum are grown in the low ground, and in the hill clearings sugar cane, plantains, and cotton; the garden cultivation consists of mangoes, pineapples, and jacks of inferior quality.

Cattle are raised, but ponies are scarce; coal has been reported in the vicinity of Sandoway town, but is probably of inferior quality. Silk and cotton weaving are common: there are sugar mills and a steam sawmill near Sandoway.

Trade.—The principal exports are salted fish, fish paste, rice, timber, cattle, horns, hides, tamarinds, chillies, jaggery, and cocoanuts; and imports, cotton twist, silk, and other apparel, oils, and iron; tobacco and betel nuts are also imported.

Ports.—The principal anchorages are off the mouth of the Sandoway river, from which the town is distant 15 miles, and at Gwa.

Chart 829, Cocanada to Bassein river.

Communication.—Steamships.—Steamers of the British India Company call at the mouth of the Sandoway river every week, but only small steamers of about 20 tons can ascend to the town. There are only about 20 miles of metalled roads, the remainder being merely foot tracks.

Climate.—The climate is considered to be more pleasant and healthy than other parts of Arakan, the year being divided into the cold season, from November to February, the hot season, from February to May, and the wet season, from May to October, the mean monthly temperature being 90° in June and 72° in January. The rainfall is very heavy, and during the three years ending 1904 it averages 189 inches over the district, being 158 inches at Gwa, 201 inches at Taungup, and 198 inches at Sandoway; July is the wettest month.

Chart 830, Bassein river to Pulo Penang.

BASSEIN, a district of the Irrawaddy division of Burma, forming an irregular wedge-shaped strip of land and delta, narrowing from north to south, lies between the parallels of 15° 50′ and 17° 30′ N. and the meridians of 94° 11′ and 95° 28′ E., and has an area of 4,127 square miles.

The port of Bassein has long been of trading importance, and in 1687, after unsuccessfully attempting settlement on the Irrawaddy delta, the East India Company occupied Negrais (now known as Haing-gyi) island, and in 1757 obtained land at Bassein, but in 1759 the settlers were nearly all murdered. Bassein was held as a pledge by the British in 1824, during the first Burmese war, and in the second war, in 1852, was finally occupied.

Physical features.—The Yoma mountains, entering the district at its north-west corner, and stretching down its western side at no great distance from the sea, divide it into two unequal parts, the main portion, a flat alluvial plain, being on the eastern side.

Rivers.—The whole country is intersected by tidal channels, mostly unimportant, the principal river being the Bassein, which, branching off the Irrawaddy above Henzada, runs almost due south through the district and enters the sea at Negrais by two mouths, the eastern silted up. The western branch is navigable for vessels of 27 feet draught, and leads to Bassein town.

Inye lake, in the north-east part, is 7 miles in circumference, and averages 15 feet in depth in the dry season.

Geology.—North of Bassein town are considerable beds of laterite, and on the west coast a remarkable patch of calcareous sandstone occurs; the Eocene group of rocks is well developed, which in the south are termed the Negrais beds. Near Ywatpa is a mud volcano, supposed to be connected with others in Arakan.

Flora and fauna.—The main varieties of timber trees are found, and inland are evergreen forests, while large areas of mangroves grow near the rivers, and palms of various kinds are common.

Tigers are scarce, but elephants, sambar, bison, leopards, and bears are fairly common; the rhinoceros is nearly extinct. Crocodiles are found in the tidal creeks, and there are rich turtle beds in the coast near the south.

Population.—In 1901 the population was 391,427, chiefly Buddhists, the languages spoken being Burmese and Karen.

Products.—About one-fifth of the whole area is under rice, and tobacco and the dani palm are cultivated; there is also some garden cultivation. Cattle are raised, but disease is rife.

The fisheries are valuable, those of Inye lake being the most important, both loggerhead and green turtle are plentiful on the southern coast; the only minerals are pottery clay, laterite, limestone, and sandstone.

The hand industries are pot making and umbrella manufacture. There are several rice and saw mills.

Trade.—The maritime export trade is practically confined to rice, and the imports are piece goods and hardware.

Ports.—Bassein is the principal port.

Communication.—Steamships.—No sea-going lines of steamers call at Bassein, but the Irrawaddy Flotilla Company run steam vessels from Bassein three times every week to Rangoon, *viâ* Myaungmya, Wakema, and Ma-ubin, and to Kyonpyaw; also daily steamers to Myaungmya, and twice weekly to Ngathainggyaung, and in the rains to Henzada. Scarcely any village of size eastward of the Yoma mountains but has communication by small steam vessels.

Railways.—The Bassein-Henzada-Letpadan railway runs from Bassein town for 66 miles through the district.

The roads are chiefly in the vicinity of Bassein town, as in the south all communication is by water.

Climate.—The climate is rather relaxing, though the strong sea breezes, which spring up in the afternoons, temper the summer heat. The mean maximum temperature is about 95° in the hottest months, and the minimum about 75°.

The rainfall is heavy, the annual average for the district during the ten years ending 1904 was 113 inches, the lowest fall being at Kyonpyaw, where it was 88 inches.

Chart 830, Bassein river to Pulo Penang.

MYAUNGMYA, the delta district, lying immediately eastward of Bassein, and between the parallels of 15° 44′ and 16° 55′ N., and the meridians of 94° 36′ and 95° 35′ E., has an area of 2,663 square miles. The district is of modern formation, and has no particular history.

Physical features.—It consists of a number of flat, fertile islands, separated by rivers or tidal creeks, mostly navigable, and, with the exception of a small tract of rising ground, about 30 miles southward of Myaungmya town, the general surface is little above the rise of spring tides. Near the coast stretches of mangrove jungle and dani palms border the mud creeks, while farther north are plantain groves and pagodas, otherwise it would present but a waste of wide rice flats, chequered with strips of grass and tree jungle.

Rivers.—The waterways, all branches of the Irrawaddy, are the main natural features; on the western side it is skirted by the Panmawaddy, which flows into Bassein, but leaving a branch, the Thetkethaung, still bordering it.

The Pyamalaw, running down the centre of the district, enters the sea by two mouths, named the Pyamalaw and the Pyinzala. The Irrawaddy, forming the eastern boundary for 24 miles, divides and forms two branches, the western named the Yazudaing, and between this and the Pyinzala is the Shwelaung, which, after flowing for 25 miles, joins a branch of the Irrawaddy, and becomes the Kyunpyatthat, joining the Irrawaddy 24 miles from the sea. There are other smaller rivers.

Geology.—The soil is composed of alluvial formation, resting on a substratum of black clay, but in the hilly tract are rocks of the Eocene group.

Flora and fauna.—Tidal and swamp vegetation predominate, and the flora is of the type common to river deltas.

Elephants and tigers are found in the southern and unreclaimed parts, and leopards everywhere; sambar and barking deer are fairly plentiful in some places, and monkeys abound in the southern forests, while crocodiles infest the smaller creeks; turtle and tortoises are common on the sea coast.

Population.—The total population, in 1901, was 278,119, about two-thirds being Burmans and one-third Karens, and both Burmese and Karen are spoken.

Products.—Rice is principally grown, but there are plantain groves, and the dani palm, sugar cane, and sesamum are also cultivated. Buffaloes and cattle are bred, and turtle banks exist along the coast. Pottery constitutes the only domestic occupation, and salt and fish paste the only manufactures.

Chart 830, Bassein river to Pulo Penang.

Trade.—Rice and fish paste are the chief exports, and the imports comprise piece goods, hardware, kerosene oil, &c.

Ports.—The ports, or rather stopping places of the steamers within the district, are Myaungmya, Wakema, and Shwelaung.

Communication.—Steamships.—The main steamer route from Rangoon to Bassein traverses the district by the cross streams which connect the rivers, and the main trade centres are kept in regular communication with each other by services of small steamers and launches.

Railways.—A light railway to connect Myaungmya with Pantanaw, in the Ma-ubin district, is contemplated.

Climate.—Although enervating, the climate is not altogether unhealthy, and its proximity to the sea makes it more equable than farther inland. The average maximum temperature is about 95°, and the thermometer never rises above 105°; the average minimum is about 65°, the average mean being 80°.

The rainfall is heavy and regular, varying locally, being from 90 to 130 inches in the southern, and from 70 to 90 inches in the northern, parts.

PYAPON, the delta district which forms the eastern boundary of Myaungmya, is in the shape of a truncated triangle, the sides of which are the Irrawaddy, on the west, and the China Bakír river on the east, the base being the sea coast; it lies between the parallels of 15° 40′ and 16° 41′ N., and the meridians of 95° 6′ and 96° 6′ E., and has an area of 2,137 square miles.

As in the case of Myaungmya, it is of recent formation, having been a stretch of unreclaimed jungle until recent years.

Physical features.—It consists of a vast plain, intersected by tidal creeks and waterways, and, with the exception of very small areas, named kondans, which are narrow strips of land from 4 to 10 feet above the level of the plain, it is subject to inundation at high water, spring tides.

Rivers.—The rivers, which are the south-eastern portion of the network forming the outlet of the Irrawaddy, are all tidal, and that river, which, with one exception, is the boundary between this district and Myaungmya, is navigable for river craft at all seasons of the year.

The China Bakír river forms the eastern boundary, and its western mouth is known as the Pyapon, and between it and the Irrawaddy the Byondon runs into the sea near Pyindaye, the lower reaches of this river being separated from the Irrawaddy by two large islands covered with fuel reserves.

Geology, &c.—The geology, flora, and fauna are practically the same as given for Myaungmya.

Chart 830, Bassein river to Pulo Penang.

Population.—In 1901 the population was 226,443, of which 88 per cent. are Burmans and Karens, in the northern portions; Burmese and Karen are spoken.

Products.—Rice is principally grown, and near river banks there is garden cultivation, the dani palm, betel nuts, and cocoanuts being cultivated. Domestic animals are not bred in any numbers. The fisheries are valuable, the most important inland being an area in the north, enclosed by three rivers; turtle beds along the coast yield large numbers of eggs annually; fish paste and rice milling are the only manufactures.

Trade.—The principal exports are rice, fish paste, horns, hides, and firewood, and imports, silk and cotton goods, kerosene oil, sugar, salt, jaggery, pickled tea, areca nuts, hardware, and cutlery crockery.

Ports.—Pyapon, Kyaiklat, and Dedaye are the principal towns where steamers call.

Communication.—Steamships.—The Irrawaddy Flotilla Company maintain an extensive service of steam vessels; launches plying daily between Pyapon and Rangoon, calling at Kyaiklat and Dedaye, and by-weekly steamers run from Moulmeingyun, in the Myaungmya district, *viâ* Bogale, Pyapon, Kyaiklat, and Dedaye, calling at Pyindaye in the dry season.

Climate.—The climate, although damp and depressing, is healthy, the proximity of the sea rendering it equable. The average maximum temperature is about 95°, the average minimum 65°, and the average mean 80°.

The rainfall is heavy and regular, the average annual fall being about 95 inches, decreasing towards the north.

HANTHAWADDY, a district of the Pegu division of Burma, which lies on the eastern side of Pyapon, and between the parallels of 16° 19′ and 17° 47′ N., and the meridians of 95° 45′ and 96° 45′ E., has an area of 3,023 square miles. In the centre, and completely surrounded by it, is the separate district of Rangoon; and the Cocos and Preparis islands form a part of it.

It originally formed part of the Talaing kingdom, and, with the rest of Pegu, came under British rule at the close of the second Burmese war. In 1879 it was separated from Rangoon; in 1883 it was split in two; in 1895 its limits were enlarged by the addition of Kyauktan, and in 1903 the last revision of boundaries was made.

Physical features.—It is a vast deltaic plain, broken only by the spurs of the Pegu Yoma, which separate its northern part from Pegu; these mountains attain a height of 2,000 feet. The sea coast is low, showing large stretches of mud at low water, and inland, except in the vicinity of Rangoon, the land consists of rice cultivation

Chart 830, Bassein river to Pulo Penang.

and swamp, relieved by scrub jungle, with numerous waterways near the sea.

Rivers.—The main stream is the Hlaing, which, entering the district near its northern end, flows southward through it, and is navigable throughout the district by native craft. The Rangoon river, which, as the Pegu, joins the Hlaing near Rangoon, flows southward into the Gulf of Martaban.

Geology.—The plains are composed of homogeneous post-Tertiary alluvium, resting on a bed of water-worn gravel; the Pegu Yoma is skirted by a broad bed of sandy deposit, and laterite is found on many of the lower hills.

Flora and fauna.—The coastline is fringed with dense low mangrove jungle, covered regularly by the tide, beyond which are tidal forests from 40 to 50 feet high. Nipas and pandanus form dense bushes, and creepers and climbers abound, while behind this are either open evergreen tropical or low deciduous forests.

Elephants, bison, and various kind of deer are common in the mountains, the rhinoceros is rare, but tigers and leopards are increasing; the fish-eating monkey and the short-nosed crocodile frequent the tidal creeks.

Population.—The total population, in 1901, amounted to 484,811, the majority being Bermans, and others Karens, Talaings, and Shans. Burmese is the ordinary language, but Tamil and Telugu are also spoken.

Products.—Rice is the only crop of importance, but fruit and vegetable gardens, growing pineapples, mangoes, jack fruit, marian plums, betel nuts, and other fruit and vegetables, may be noticed. Cattle and buffaloes are bred, and laterite and pottery clay are produced.

Cotton weaving is carried on; salt and fish paste are manufactured; and coarse mats woven. There are rice mills, saw mills, and an oil refinery. The fisheries, mostly in the western part of the district, are valuable.

Trade.—With the exception of teak and other forest produce, rice composes the entire export, and the principal imports consist of piece goods, salt, oil, sugar, hardware, oilman's stores, gunny bags, rope, and miscellaneous goods.

Ports.—Rangoon is the principal centre for steam vessels.

Communication.—Steamships.—The Irrawaddy Flotilla Company have daily service of steam vessels from Rangoon to Thongwa, *viâ* Kyauktan, and from Rangoon to Twante through the canal. From Rangoon, launches run daily down the Rangoon river to Kungyangon villages, and up the Pegu river to Kamamat, and a

Chart 830, Bassein river to Pulo Penang.

regular service is maintained on the Hlaing river; a steam ferry plies between Rangoon and Syriam, and boat ferries are on all the chief lines of communication.

Railways.—The Rangoon-Prome railway runs from south to north for 60 miles through the district, and the Rangoon-Mandalay line runs north-eastward.

Canals.—The Twante canal provides the quickest route from Rangoon to the main stream of the Irrawaddy, and is much used by small river steamers and boats.

Climate.—The moist and depressing climate is not altogether unhealthy. The heat is oppressive from the middle of March till the rains break in May, and the nights the same from the end of the rains, in September and October; the days are often muggy and trying.

December and January are cool and pleasant, the average minimum temperature being 60°. In the southern part, where the air is cooled by the sea breeze, the maximum is from 83° to 95°, increasing farther north.

The rainy season lasts from May to October, with sometimes two or three days in spring, and the average annual rainfall is 94 inches at Insein, 98 inches at Rangoon, and 119 inches at Kyauktan.

THATON, the district which occupies the sea coast stretching from the Sittang to the Gyaing rivers, lies between the parallels of 16° 28′ and 17° 51′ N., and the meridians of 96° 39′ and 98° 20′ E., has an area of 5,079 square miles.

It comprises the greater part of the ancient Talaing kingdom, and was easily occupied by the British in the first Burmese war, in 1824, but was given up afterwards, and again occupied during the second Burmese war, at the end of which it was taken over by Britain.

Physical features.—It is intersected by three main groups; the Dawna range, in the east and north-east parts, varies in height from 1,000 to 5,500 feet; the Taungmyo range, separated from the Dawna by a plain some 50 or 80 miles wide, separates the Ataran valley, in Amherst district, from the seaboard townships, and continues in the Martaban hills, which, from Moulmein, run north and north-west into the Salween district.

In the north-west part of the district. between this last range and the Sittang estuary, is a limestone range entering from the north, the western spur of which, known as the Kelatha hills, rises to a height of 3,650 feet opposite Sittang village.

Rivers.—The Sittang, for the last 40 miles of its course, forms the western boundary. The Bilin, which enters the district from Salween and flows between the Martaban and Bilin hills, has a course of 280 miles, and discharges into the Gulf of Martaban.

Chart 830, Bassein river to Pulo Penang.

The Salween river, entering the northern corner of the district, has a southerly course, and divides it, roughly, in half; it flows into the sea at Moulmein, where it is divided into two mouths by Bilugyun island.

The Hlaingbwe and Haungtharaw rivers, combine about 45 miles from the sea, and, under the name of Gyaing, form the south-eastern border of the district.

Geology.—Very little is known of the geology; the hills are mostly of laterite or limestone, and the low-lying tract in the south-west part has at one time emerged from the sea.

Flora and fauna.—The flora is that ordinarily met with in the wet areas of Lower Burma.

A few wild elephants are found in the north-west and north-east parts, leopards abound, tigers are not numerous, but bears are common, and the barking deer and hog deer are plentiful in places. The scarcity of wild fowl is remarkable.

Population.—In 1901 the population was 343,510, Karens being the most numerous; Burmese, Karen, Talaing, and Taungthu are the languages spoken.

Products.—Rice is the main crop, and garden cultivation is of various kinds; sugar canes, plantains, durians, and areca palms are grown. Cattle breeding is extensively practised, and buffaloes and goats are reared to a small extent. There are 72 fisheries, and fishing and fish curing occupy a number of inhabitants; manufactures may be considered as non-existent.

Trade.—Rice is principally exported, and other exports are teak, firewood, and lime; the chief imports are cattle.

Ports.—Martaban is the chief port.

Communication.—Steamships.—Steam launches run from Moulmein up some of the rivers, and a navigable canal, 13¼ miles long, connects Sittang river with Kyaikto, which is served by a steam launch.

Railways.—A light railway, 8 miles long, runs from Thaton town to Duyinzeik.

A railway from Pegu to Martaban is in course of construction.

Climate.—The climate, moist and oppressive, is generally salubrious, shows no extremes of temperature, and, near the sea, enjoys a cool breeze. The average mean temperature for the following months registered during the decade ending 1901, was 74° in January, 84° in April, 77° in July, and 82° in October.

The rains are heavier in this district than in any other part of Burma, except, perhaps, Tavoy and Sandoway; the average rainfall for six years ending 1901 was 201 inches at Thaton, and 196 at Bilin.

Chart 830, Bassein river to Pulo Penang.

AMHERST, the district lying to the southward of Thaton, and between the parallels of 14° 56′ and 17° 2′ N., and the meridians of 97° 27′ and 98° 51′ E., is in the Tenasserim Division of Burma, and has an area of 7,062 square miles. Originally Siamese territory, it was conquered by the Burmese in 1760, and became a British possession in 1826.

Physical features.—It consists for the most part of alluvial plain, shut in on the west by the low Taungnyo range, running parallel to the coast, and on the east by the Dawna hills, and in the extreme east is a narrow, densely-wooded region. The highest part of the Dawna range is 5,500 feet, and this range throws out numerous spurs, and extends south-eastward for about 200 miles.

Rivers.—The chief rivers are the Salween, the Gyaing, the Ataran, and the Thaungyin.

The Salween enters the sea about 28 miles south of Moulmein, where it is a broad, shallow waterway obstructed by shoals, preventing the entry of seagoing vessels, except at its southern mouth; for hundreds of miles from its source it is swift, narrow, and turbulent.

The Gyaing, already mentioned, has islands and sandbanks choking it, but is navigable for native boats and launches all the year round.

The Ataran, formed by the junction of the Zami and Winyaw streams, in the southern part of the district, is narrow, deep, and sluggish, and runs in parts between high banks, with dense overhanging foliage.

The Thaungyin rises in the Dawna hills, joins the Salween after a course of about 200 miles, and has breadths of from 100 to 1,000 feet, but is unnavigable on account of rapids.

Geology.—The Moulmein group of rocks, consisting of hard sandstone, grey shaley beds, fine soft sandstone, and hard thick limestone, are well developed; they rise precipitously from the plain around Moulmein, and are one of the chief features. Hot springs occur in several parts, the largest near Ataran village, which spring has a temperature of 130° F. Lead ore has been found.

Flora and fauna.—There is excellent timber, and the dani palm and bamboo abound, while fruit trees are exceptionally plentiful; orchids are common in the hills.

The principal animals are the tiger, the leopard, the bison, and the hog; the rhinoceros is found in some parts, and the Malayan tapir is reported.

Population.—The population, in 1901, numbered 300,173, five-sixths of whom were Buddhists; Talaing is the language most in use.

Products.—Rice is principally grown, and garden cultivation consists of areca and cocoanut palms, sugar canes, and plantains;

there are also some rubber trees. Cattle and buffaloes are bred, and are plentiful; goats are also fairly numerous.

Some gold and silver work is produced, and ivory carving is a speciality; there are a number of saw and rice mills, a steam joinery, and a foundry.

Trade.—The chief exports are rice and timber, and imports vegetable oils, tobacco, gunny bags, betel nuts, sugar, spices, cotton twist and yarns, cotton, silk, and woollen piece goods, machinery, metals, and kerosene oil.

Ports.—Moulmein is the principal port.

Communication.—Steamships.—Moulmein is connected with Rangoon by steamers running three times weekly, and there is a regular steamer service from Moulmein, passing down the Tenasserim coast, calling at the port of Yé.

Steamboats also run between Moulmein and Kado, on the eastern bank of the Salween, and also to several points on the Gyaing, Haungtharaw, and Ataran rivers.

A steam ferry will connect Moulmein with the railway under construction to Pegu.

Climate.—The coast and low-lying country are hot, and have no real cold season, but in the hills the temperature is quite low in winter and the nights are fairly cool in the plains, except for short periods in April and October. The mean maximum and minimum temperatures throughout the year at Moulmein are 89° and 73° respectively.

During the decade ending 1900 the rainfall at Moulmein averaged 188 inches, 213 at Amherst, and 166 at Kawkareik. From the beginning of November to April there is practically no rain.

TAVOY, the district lying next southward of Amherst, and between the parallels of 13° 16′ and 15° 6′ N. and the meridians of 97° 46′ and 99° 12′ E., has an area of 5,308 square miles. Its history is obscure, but it belonged at various times to Siam, Pegu, and Ava; in 1757 it was a province of Siam, in 1759 it became Burmese, and during the first Burmese war an expedition was sent against it by Britain; since 1829 it has remained in undisturbed British possession.

Physical features.—It consists of a rugged tract, 150 miles long and 50 miles broad at its widest part, and, except for the Tavoy basin and a narrow strip along the coast, is composed of hills. The ranges run generally north and south, one dividing the Tavoy river from the sea, a second forming the watershed between the Tavoy and Tenasserim rivers, while the third is near the boundary between the district and Siam. The highest peak is Myinmoletkat, 6,800 feet high.

Chart 830, Bassein river to Pulo Penang.

Rivers.—The Tenasserim, rising in Myinmoletkat peak, flows north, then sharply turns east, and runs into Mergui district; in the dry season it is only navigable for canoes.

The Tavoy rises in the northern part of the district, flows south past Tavoy town to the sea, and is navigable for light-draught steam vessels to Tavoy, and for 40 miles farther by boats.

The Moscos islands, rocky and uninhabited, lie about 10 miles off the coast.

Geology.—The mountains appear to be granite, the intervening valleys having patches of clay slate. The coast hills contain an abundance of micaceous iron ore and clay ironstones, and near Tavoy is an elevated ironstone ridge; the plains are composed of stiff clay.

Flora and fauna.—Besides timber trees, the castor-oil plant, sarsaparilla, and the sea cocoanut grow, and there are several vegetable dyes.

The wild animals include elephants, tigers, leopards, hog deer, barking deer, Malay bears, hogs, monkeys, the rhinoceros, and the sambar; orang-outang is reported to be found in the hills. Birds include the peafowl, the pheasant, and the hornbill. Fish abound, crocodiles are numerous, and the sea beaches are frequented by turtle.

Population.—In 1901, the population was 109,979, of which 96 per cent. were Buddhists, and the principal language is Burmese.

Products.—Rice is the chief product, and a large area is planted with fruit or palm trees, while on small areas cotton, hemp, cardamoms, tobacco, and coffee are grown. Cattle and buffaloes are largely bred, and goats to a small extent. Tin is worked, salt is manufactured, and Tavoy town is noted for silk weaving.

Trade.—The chief exports are rice, salt, and timber, and precious stones are the principal import.

Ports.—Sinbyubyin, about 10 miles within the entrance to the Tavoy river, is the chief port.

Communication.—Steamships.—The weekly steamer of the British India Company, running between Rangoon and Mergui, calls at Sinbyubyin, and passengers and cargo are transhipped to a steam launch, which ascends the river to Tavoy, 26 miles distant.

A steamer of the above company also connects the port with Moulmein fortnightly, and a coasting steamer, between Rangoon and Penang, every eighteen days.

There are 185 miles of metalled and 74 of unmetalled roads.

Climate. — Sea breezes moderate the intense heat in the hot season, and during the cold season the temperature in the shade is seldom 92°, falling in the early morning occasionally to 57°.

Chart 830, Bassein river to Pulo Penang.

The rainfall is heavy, the average fall for three years ending 1904 being 228 inches, and at Launglon it has been known to reach 252 inches, the highest recorded in the province.

MERGUI, the southernmost district of Burma, extends from Myinmoletkat peak, in the north, in lat. 13° 28′ N., to the mouth of the Pakchan river, in 9° 58′ N., and includes the islands of the Mergui archipelago, from Tavoy island to Christie island, which stretch westward to 97° 30′ E.; the total area is 9,798 square miles.

The district, which has ever been a battle ground between the kingdoms of Burma and Siam, was at different times held by each of them, while in the seventeenth century it was in the hands of the French for a short period; at the end of the eighteenth century it belonged to Burma, but when war was declared, in 1824, it, with Arakan and Tenasserim, came under British rule.

Physical features.—In the northern part the Great Tenasserim valley is separated from the sea by a mountain range, having Myinmoletkat peak on the northern border, and between this range and the coast is a fertile plain watered by small streams. In other parts such level land as exists is mostly covered at high water by the sea, or inland, flooded during rains.

Rivers.—The principal rivers are the Great and Little Tenasserim, the Lenya, and the Pakchan.

The Great Tenasserim, rising in Tavoy, enters the district about 140 miles above Tenasserim village, where it turns back on itself and flows into the sea; the Little Tenasserim, flowing northward, joins it at the village of the same name.

The Lenya, south-west of, and nearly parallel to, Little Tenasserim, after a bend to the north-west, runs direct to the sea.

The Pakchan, rising near the Lenya, flows south to Victoria point, and from Pakchan downwards forms the boundary with Siam.

Mergui archipelago.—*See* page 57.

Geology.—Coal is found in association with shales, sandstone, and conglomerates, which form a tertiary basin. The Mergui group, sedimentary beds with embedded fragments of felspar, are under the Moulmein group, which constitute the greater part of the sedimentary rocks. Rocks of the gneissic series, with granite in which there are tin ores, also occur.

Flora and fauna.—The flora resembles that of Tavoy, but there is a good deal of swamp vegetation; canes are abundant. Monkeys, especially the fisher monkey and the white-handed gibbon, swarm; elephants, tigers, barking deer, and hogs are plentiful, and the rhinoceros, the bison, and the sambar are found. The archipelago abounds with fish, prawns, and shrimps; pearls and other shellfish are found, and whales are frequently seen.

Chart 830, Bassein river to Pulo Penang.

Population.—The population, in 1901, numbered 88,744, mostly Burmans, with some Siamese and Chinese, and a wild people, known as Salons, live among the islands; Burmese, Siamese, Malay, and Chinese are spoken.

Products.—Rice, dani palms, areca palms, and durians are grown, and buffaloes are bred. About one-eighth of the population is engaged in fishing, and next to this is pearling in the archipelago; green snails and bêche-de-mer are also maritime products. The edible birds' nests of the swift are found on the islands.

Tin is mined and smelted; gold exists in many places, but not so far in paying quantities, and coal of superior quality to the generality of Indian coal is said to exist in large quantity.

Trade.—Tin in blocks, pearls and shells, green snails, birds' nests, and bêche-de-mer are exported.

Ports.—Mergui is the principal port, the others being Palaw and Victoria point (Kansong).

Communication.—Steamships.—The British India Company's weekly steamer from Rangoon calls at Mergui, and also the fortnightly one from Moulmein. A small Chinese steamer from Penang calls at Victoria point and other small ports. Roads scarcely exist, owing to the water communication.

Climate.—The district is unusually healthy for a tropical climate, and malaria is little known. The mean maximum temperature at Mergui town is 93° in April and 85° in August, and the mean minimum 68° in December and 75° in April and May.

The rainfall during the five years ending 1901 was 103 inches.

Mergui islands.—The Mergui archipelago extends from about lat. 8° 30′ N. for a distance of about 300 miles, and consists of over 200 islands, covering an area of roughly 10,000 miles; probably the earliest detailed account of the islands is from a Captain T. Forrest, who visited them in 1792. They were taken over from Burma by the British in 1826.

They are nearly all high, and on the larger ones the mountain ranges run north and south, parallel to the coast, the islands being in two parallel chains; the whole archipelago is within the 50-fathoms contour line. Dense jungle covers all the islands, coming down to the water's edge in the case of the more precipitous ones, while the lower islands are often fringed with mangroves; a conspicuous feature of the northern islands is the large number of blasted trees, said to have been caused by a cyclone, which stand above the jungle.

Geology.—The Moskos group is mostly granitic, but many of the other islands are in the main sedimentary, being composed of considerably contorted beds of soft shales and sandstones, often showing signs of merging into quartzites.

Flora and fauna.—The forest, although not so lofty, partakes of the character of the typical rain forest, and is evergreen and rich in woody lianas and epiphytes; in the drier parts a species of casuarina is not uncommon. Pandanus is occasionally met with, and rubber (*ficus elastica*) is said to grow wild on some of the islands; a species of *Dipterocarpus* is in great demand for the resin which it yields. Plantains, cocoanut palms, and pineapples do not grow wild, but are found near the parts inhabited by fishermen.

The only really abundant mammals are monkeys, of which there are two species; a small chevrotain is found on some of the larger islands, and wild pigs appear to be fairly common.

Over one hundred species of birds have been recorded, but many, being inhabitants of the jungle, are not usually seen; the most conspicuous bird is the hornbill, and herons are very common on the mud flats; pigeons, including the imperial pigeon, are found in the jungle, and the edible nested swift breeds on certain of the islands.

Crocodiles are said to be very common in the muddy estuaries, and many species of water snakes have been recorded; lizards and geckos abound, and the large turtle is of commercial importance. Sharks are numerous, and the huge sting ray is abundant.

Population.—The principal inhabitants are the Selungs, or sea gypsies, a nomadic, timid, and unobtrusive people, whose numbers it is difficult to estimate, as they cruise between the islands in their frail-looking canoes; they probably number over 800. There is a large influx of people to the archipelago between September and April, which is the pearling season.

Products.—The most important product is the shell of the mother-of-pearl oyster, for which divers go down to a depth of 28, and occasionally to 30 fathoms; the season is from September to May, and diving is only carried on at neap tides. Green snails and trocas shells are gathered for their mother-of-pearl shell, but owing to the limited amount of coral bottom, the bêche-de-mer is not found in any great quantity; the edible birds' nests of the swift (*Collocalia unicolor*) and the eggs of the large turtle are collected.

The only two manufactures of the islands are torches and mats, the former made from the resinous tree, already mentioned, and the latter, simple and serviceable, woven from the strips of pandanus leaf.

Trade.—As much as 340 tons of pearl shell has been sent to Mergui in a season, which has realised £140 a ton, and 80 tons of green snails are often collected during the same period, selling at £45 a ton. The price of bêche-de-mer is £6 per ton, and only from 5 to 20 tons will be obtained, but the birds' nests are sold at about double their weight in rupees, being about 10d. each, or some £5 per pound; turtles' eggs, from 200 to 300 in a nest, sell for about 3s. 6d. per hundred.

NICOBAR ISLANDS.—The Nicobar islands, lying in the Bay of Bengal, between the 6th and 10th parallels N., and the meridians of 92° 40′ and 94° E., occupy a space of 163 miles in a north-north-west and opposite direction, with an extreme width of 36 miles. The earliest mention of them is in the year 672, under the name of the Land of the Naked People, but, except in a few cases, the modern geographical names have not been traced to their sources.

They are a dependency of the Andaman islands, consist of twelve inhabited, and seven uninhabited, islands, and are generally hilly and undulating.

The chief summits are Mount Thullier (2,105 feet), on Great Nicobar; and Mount Deoban (1,428 feet), and Empress peak (1,420 feet), on Little Nicobar.

Rivers.—The only island with rivers is Great Nicobar, on which are Galathea (Dak Kea); Alexandra (Dak Anaing); and Dagmar (Dak Tayal), considerable and beautiful streams.

Geology.—Little is known of the geology, but the southern islands are composed of sandstones and shales, and some of the northern of clay stones and conglomerates. Although forming part of a submarine chain known for its volcanic activity, there are no traces of true volcanic rocks.

Flora and fauna.—The timber trees are not so good as those of the Andamans, but cocoanuts, betel nuts, mellori, and thatching palms grow, and the palms are exceedingly graceful; large clumps of casuarina and great tree ferns are features of the landscape.

Of cultivated fruit are pumelos, lemons, limes, oranges, shaddocks, papayas, bael fruit, custard apples, bullocks' hearts, tamarinds, jacks, and plantains, besides sugar canes, yams, pineapples, and capsicums.

There are no indigenous wild animals, but some buffaloes and cattle left on Camorta have become wild. Monkeys are found on some islands, and crocodiles in the rivers, and of marine fauna are coral, bêche-de-mer, oysters, pearl oysters, turtle and tortoise shell, also edible birds' nests and an inferior quality of sponge.

Population.—In 1901 the total population was 6,511, the inhabitants, not being divisible into tribes, but rather the people of various islands or groups.

Products.—Neither rice nor cereals are cultivated, but cocoanuts and tobacco are grown, and garden cultivation receives considerable attention. They are good carpenters, and pottery for domestic use is manufactured.

Chart 830, Bassein river to Pulo Penang.

Trade.—The export consists of whole cocoanuts and copra, edible birds' nests, split cane, betel nut, bêche-de-mer, ambergris, and tortoise shell.

Ports.—There is a fine landlocked harbour, named Nancowry, between Camorta, Nancowry, and Trinkat islands, and a small one between Pulo Milo and Little Nicobar, besides which there are a number of good anchorages.

Earthquakes.—The islands apparently lie in the local line of greatest fault, so that severe earthquakes may be expected, and ones of great violence are recorded in 1847, in 1881 (with a tidal wave), and milder shocks in 1899.

Climate.—The climate is very hot, except when raining, and unwholesome for Europeans, being in some places dangerously subject to malaria. The observations for temperature, &c., are very incomplete, but the highest temperature registered would appear to be 98·2°, and lowest 64° in the shade; the mean maximum at Nancowry harbour is about 92°, and the mean minimum about 72°.

The rainfall varies considerably, as at Nancowry harbour it was 93 inches in 1885, and 165 inches in 1887.

ANDAMAN ISLANDS, a group in the Bay of Bengal, which lies about 120 miles from Cape Negrais, in Burma, and about 340 miles from the north end of Sumatra, consists of 204 islands and rocks, and occupies a space of 219 miles in a north and south direction, with an extreme width of 32 miles. The Cocos and Preparis islands are situated between them and Cape Negrais.

The principal islands consist of five, known as Great Andaman, and named North, Middle, and South Andaman, Baratang, and Rutland island, Little Andaman being 3 miles to the southward. The chief outlying islands are North Sentinel, Barren island (800 feet), a volcano which has been quiescent for about a hundred years, and Narcondam (2,150 feet), also an extinct volcano, and which is 71 miles eastward of the group.

The name is supposed to be Malay, signifying "the abode of monkey people," and in a great Tanjore inscription of 1050 they are named Timatittivu, "Islands of impurity," and as the abode of cannibals; in Chinese history they were known as Rakshasas, or ogres.

The islands, with the Nicobars, are administered by a Chief Commissioner, resident at Port Blair.

Physical features.—They consist of a mass of hills enclosing very narrow valleys, the whole covered by exceedingly dense tropical jungle. Especially on the east coast, the hills rise to a considerable elevation, the chief heights being Saddle peak (2,402 feet), in North Andaman; Mount Diavolo (1,678 feet), in Middle Andaman; and

Koiob (1,505 feet), Mount Harriet (1,193 feet), and Cholunga range (1,057 feet), in South Andaman; Fords' peak rises to 1,422 feet on Rutland island. Little Andaman island, except in its north extreme, is practically flat. There are no rivers and few perennial streams in the group.

Geology.—Geologically the group forms a southward continuation of the Yoma range, and consists of two sedimentary series, of which the first are non-calcareous grey sandstones and imbedded shales, with occasional nests of poor coal, conglomerates, and pale-grey limestone. The other series consist of soft limestone formed of coal and shell sand, soft calcareous sandstones and white clays, with occasional conglomerates. Serpentine is found in the Cinque islands and elsewhere, and chromite, asbestos, and valuable minerals may be expected.

Flora and fauna.—Pandanus and nipa palms grow near the sea, but cocoanuts and casuarina are not found. The forests are filled with evergreen trees, and the chief and most valuable timbers are padouk, koko, chuglam, marblewood, and satinwood. There are bamboo groves, and extensive mangrove swamps. Of introduced plants are tea, Liberian coffee, cocoa, ceara rubber, Manilla hemp, teak, and a number of shade ornamental trees.

There are no dangerous mammals, a pig, a wild cat, and a iguana are hunted for food. The poisonous snakes include the cobra, the hamadryad, the blue karait, and two species of pig viper.

Population.—In 1901 the population was 1,882 divided into twelve tribes, of which the Jarawas contains the only dangerous people.

Products.—The principal crops raised are rice, pulse, maize, sugar cane, and turmeric; tea, coffee, cocoa, rubber, and hemp are cultivated. Red clay for bricks, a reddish marble, red ochre, and mica, in workable quantities, are all found, and edible birds' nests, oysters, turtle, and tortoise-shell are obtained.

Trade.—Valuable woods are exported, as also tea, coffee, cocoa, rubber, edible birds' nests, turtle, and tortoise-shell.

Ports.—The islands are deeply indented, forming a number of harbours, some very spacious; the principal are Temple sound, Interview passage, Port Anson, Port Campbell, Port Mouat, and Macpherson strait, all on the west coast. On the east coasts are Port Cornwallis, Stewart sound, Elphinston harbour, Colebrooke passage, Port Meadows, and Port Blair.

Climate.—Although tempered by sea breezes, the climate is always warm, and very hot when the sun is northing.

The rainfall is irregular, but it is usually dry during the North-east, and very wet in the South-west, monsoon. The average yearly fall is

Chart 830, Bassein river to Pulo Penang.

116 inches, but there are fluctuations at the different stations, and it varies from 83 to 138 inches.

Earthquakes.—No violent earthquakes are reported, although the group lies in a line of fault; minor earthquakes occurred in 1868, 1880, 1881, 1882, 1883, 1886, 1894, and 1899.

Caution.—In the event of shipwreck, especially on, or near, Little Andaman island, care should be exercised by the crew in dealing with the natives, who are greedy for loot, and might give considerable trouble on any attempt to prevent them from acquiring it.

They might be persuaded to convey a message to Port Blair, or to act as guides through the dense jungle to that port, but they are naturally timid, and if subjected to rough treatment, would probably desert the party.

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WINDS AND WEATHER.—Monsoons.—The North-east and South-west monsoons blow over Ceylon and the Bay of Bengal, but their general direction and strength vary in different localities. The north-east and east winds of the former monsoon commence in the northern part of the bay in October, but the monsoon is not established until November, and at Ceylon not until the middle of that month.*

At Ceylon the South-west monsoon commences about the middle of May, but occasionally it sets in before the end of April; in the Bay of Bengal it is not fully established till the latter half of June.

The South-west monsoon is stronger and more regular on the eastern than on the western coasts of Ceylon. From the middle of May to the middle of August the wind, commencing at about 8 a.m., by 10 a.m. has increased to a force of from 5 to 8, but it slackens about 4 p.m., and at sunset the force is from 2 to 3, gradually subsiding towards the morning.

Heavy seas and rain accompany the South-west monsoon, on the western side of Ceylon, but on the eastern side the latter is not experienced.

Ceylon.—January.—The North-east monsoon is at its height; its general effects are parching by day, and dry and cutting at night, when it is considered injurious to health.

Between Galle and Colombo, winds from N.N.W. to N.N.E.; squalls at times from the eastward; weather generally fine and clear.

At Colombo, light showers towards the end of the month.

Between Colombo and Pamban, winds from North to N.E., moderate in the morning, stronger in the afternoon; weather generally fine.

At Pamban, N.E. wind, light, in the morning, sets in strong about noon, and falls again at sunset.

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* See also Monthly Meteorological Charts, issued by authority of the Meteorological Committee, Meteorological Office, 63, Victoria Street, London.

Wind charts of Atlantic, Indian, and Pacific oceans, 2931-2934.

February.—Dry and hot by day, but nights cool.

Between Galle and Colombo, light N.E. breezes, and cloudy at the beginning of the month; variable at the end, with occasional showers at night, when the land breeze is blowing.

At Colombo land and sea breezes set in towards the end of the month. Between Colombo and Pamban, N.N.E. winds, blowing fresh, with clear weather.

At Pamban, the same as in January.

March.—Close, hot, and sultry, with dark clouds over the land.

Between Galle and Colombo, winds unsteady, with hazy weather.

At Colombo, squalls off the land, with thunderstorms in the evening.

Between Colombo and Pamban, moderate North and N.E. winds, fine weather, with passing showers.

At Pamban, one of the finest months; N.E. winds, light and variable; South and S.W. winds occasionally blow for a day or two.

April.—An oppressive month; mean temperature about 88°; ground swell from the westward, towards the end, denoting the advent of the South-west monsoon. Wind light and variable, with calms and light showers at night; squalls of wind and rain; occasionally the South-west monsoon sets in before the end of the month.

At Colombo land and sea breezes prevail.

May.—Sky gradually becomes overcast; banks of clouds rising, and about the middle of the month the South-west monsoon commences, usually with a burst of rain, for a few hours, a clear sky supervening.

At Colombo, after the burst of the monsoon, it settles to a steady wind, with copious rain.

Between Colombo and Pamban, after the burst, the winds are mostly S.W.; a gale sometimes sets in, commencing at South, and ending about W.S.W.

June.—South-west monsoon gains considerable strength.

Between Galle and Colombo, winds vary from S.W. to W.S.W., with frequent showers and a reduced temperature.

July.—Weather more moderate on the west coast of Ceylon, and showers less frequent.

Between Galle and Colombo the prevailing winds are from West to W.S.W., moderate at night, light in the morning, and strong in the afternoon, with occasional squalls; hazy and cloudy over the land.

August.—A fine month, with fresh winds from S.W. to W.S.W., with invariably clear and cool nights.

Between Galle and Colombo, the wind veers at times to W.N.W., the afternoon breeze being stronger, with occasional squalls and rain. At Colombo, fine, with light west winds.

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September.—On the south coast, fresh W.S.W. winds, with hazy weather, and generally squally and cloudy off Galle.

At Colombo, fine, with stronger winds inclining to the westward. Between Colombo and Pamban, winds from S.W. to West, fresh, with fine but hazy weather.

October.—Weather more unsettled, but sea smooth.

Between Galle and Colombo, weather fine; winds, from S.W. to N.W. in the first part; heavy squalls, with rain at times in the latter part.

At Colombo, more unsettled; lighter winds, inclining to the N.W.; heavy rainfall.

Between Colombo and Pamban, variable winds, with cloudy, unsettled weather, and heavy squalls and rain at times.

At Pamban, South and S.W. winds, occasionally strong; variable winds towards the end of the month.

November.—On the south and west coasts, light and variable winds, between N.E. and W.N.W., with very unsettled weather and frequent heavy squalls and rain. The North-east monsoon commences about the middle of the month, with lightning, thunder, and heavy rain.

At Colombo, in the early part, winds N.W. by day, and N.N.E. by night; the North-east monsoon commences about the end, with more or less unsettled weather and thunderstorms; heavy rain falls throughout the month.

At Pamban the wind, with few exceptions, blows strongly and steadily from N.E.

December.—Between Galle and Colombo, land and sea breezes prevail, also light variable winds and calms, with showers at times; weather generally fine and clear.

At Colombo the monsoon is steady and moderate, and the wind alongshore begins about the middle of the month.

Between Colombo and Pamban, fresh N.E. and E.N.E. winds; weather in the first part, generally cloudy and hazy, with a few squalls and rain, but finer in the latter part, and winds more moderate.

Bay of Bengal.—Winds.—January.—The North-east monsoon, blowing over the bay, extends as far south as the parallel of 4° S.; the wind having a more northerly direction towards the head of the bay.

February.—The North-east monsoon prevails steadily over the bay, the winds varying from N.N.W. to N.N.E. at its head.

March.—The winds circulate anti-cyclonically, or in the same direction as the hands of a watch, being from S.E. to S.W., in the west and north-west; N.E. to East, in the south; and N.W. to North

Wind charts of Atlantic, Indian, and Pacific oceans, 2931-2934.

over the north-east and east of the bay. Occasional squalls, which raise a high sea in the north-west angle of the bay, are experienced near the head, but they seldom last for more than three or four hours.

April.—The winds are variable and unsteady, in the south, with S.W. winds of increasing strength in the north, where strong winds from the N.W. are not infrequent.

May.—The general direction is S.W., drawing somewhat to the southward off the Madras coast and at the head; strong N.W. winds come off the land occasionally at the head.

June.—The mean direction is S.W., over the greater part of the bay, blowing between S.S.W. and S.S.E. at the head.

July.—The S.W. monsoon holds steadily over the bay, its strength varying considerably, and periods of strong and lighter winds alternating; there is some decrease in its force from south to north.

August.—The wind conditions are practically the same as in July, but it draws slightly towards the south at the head, and towards the west in the eastern part. The mean force is between 4 and 5, but it varies considerably; squalls, sometimes preceding cyclones, attain forces of 8 and 9, and occasionally 10 and 11 at the head. The strength of the monsoon is considerably intensified in the centre of the bay.

September.—The mean strength of the S.W. wind is slightly less than in August, and is still lower over the Andaman islands, but there is less variation, although strong winds still alternate with lighter ones; occasionally forces of 8 to 9 are experienced, but no cyclonic conditions, and squalls are frequent on the Arakan and Tenasserim coasts.

October.—The S.W. or monsoon winds continue over the south and centre of the bay, but north of the parallel of 16° N., N.E. and east winds commence; the mean force of the monsoon wind is from 2·7 to 3·5, but it frequently increases to 5 and 7. This is the most variable and treacherous month of the year in the bay.

November.—The S.W. monsoon winds have now entirely disappeared, and N.E. winds, which in October were confined to the north, have extended to all parts of the bay. Between the parallels of 4° N. and 4° S., and eastward of the meridian of 56° E., N.W. winds, known as the "Cross Monsoon," prevail. High winds with forces of 9 to 10 may from time to time be experienced in all parts of the bay.

December.—The mean force of the N.E. winds varies over the south part of the bay, from 3 to 4, but in the centre sometimes attains the force of a gale.

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The winds on the coasts, and in the centre of the Bay of Bengal, taken from the Meteorological Atlas of the Indian Ocean, are given for each month of the year, and for easy reference, for those portions of the bay, for areas of 4° of latitude by 4° of longitude, as in that publication.

Lat.	Jan.	Feb.	Mar.	April.	May.	June.
West Coast :—						
8°—12°	N.E.	N.E.	E. by N.	S.E.	S.W.	S.W.
12°—16°	E.N.E.	East	S.E.	E.S.E.	S.S.W.	S.W.
16°—20°	N.E.	S.E.	S.W.	S.S.W.	S.W.	S.W.
20°—24°	N.N.E.	N.N.E.	S.W.	S.W.	S.W.	S.W.
Head of Bay	N.N.E.	N.N.W. to N.N.E.	W. by S.	S.W.	S.W.	S.S.W. to S.S.E.
East Coast :—						
20°—24°	N.E.	N.E.	N.W.	S.S.E.	S.S.E.	S.S.E.
16°—20°	N.N.E.	North	N.N.W.	W.N.W	S.W.	S.S.W.
12°—20°	N.N.E.	N.N.E.	N.W.	West	S.W.	S.W.
8°—12°	E.N.E.	E.N.E.	N.E.	East	S.W.	W.S.W.
Centre of Bay	N.E.	N.N.E.	N.N.E.	West	S.W.	S.W.

Lat.	July.	Aug.	Sep.	Oct.	Nov.	Dec.
West Coast :—						
8°—12°	W.S.W.	S.W.	S.W.	West	N.N.E.	N.E.
12°—16°	W.S.W.	W.S.W.	S.W.	East	N.E.	N.E.
16°—20°	S.W.	S.W.	S.W.	N.N.E.	N.E.	N.E.
20°—24°	S.W.	S.W.	S.W.	N.N.E.	N.N.E.	N.N.E.
Head of Bay	S.S.W.	S.W.	S.W.	N.N.E.	N.N.E.	N.N.E.
East Coast :—						
20°—24°	S. by W.	South	S.S.E.	E. by N.	E.N.E.	N.E.
16°—20°	S.W.	S.W.	S.W.	E. by N.	N.E.	N.E.
12°—16°	S.W.	W.S.W.	S.W.	S.E.	E.N.E.	N.E.
8°—12°	S.W.	W.S.W.	W.S.W.	N.W.	E.N.E.	E.N.E.
Centre of Bay	S.W.	S.W.	S.W.	S.S.W.	East	N.E.

The following table shows the approximate direction of the wind at the Andaman and Nicobar islands, for each month of the year.

Place.	Jan.	Feb.	Mar.	April.	May.	June.
Andaman islands	North	North	N.W.	W.N.W.	S.W.	S.W.
Nicobar islands	N.E.	E.N.E.	N.N.E.	West	S.W.	S.W.

Place.	July.	Aug.	Sep.	Oct.	Nov.	Dec.
Andaman islands	S.W.	S.W.	S.W.	S.S.W.	N.E.	N.E.
Nicobar islands	S.W.	S.W.	W.S.W.	West	N.W.	N.E.

Weather.—January.—The weather in this month is steadily fine.

February.—Fine over the whole of the Bay of Bengal, but occasional squalls near the east coast of Ceylon.

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March.—Fine weather prevails, as a rule, over the bay, but occasional squalls, hail and thunder storms, come down from the hills on the Orissa and Bengal coasts.

April.—Hot and sultry weather is experienced during the greater part of this month, with damp air, and the sky frequently clouded.

May.—The weather is frequently disturbed, and is changeable in the south, with intervals of fine weather alternating with cloudy and squally conditions, and heavy rain. Fairly fine weather and light winds usually prevail in the centre, but it is hot and sultry; at the head it is fine. Squally, with thunder and lightning, near the Andaman islands, increasing in violence and duration as the month advances.

June.—In the early part of the month, the conditions are the same as in the latter part of May, with squally and showery weather in the south and south-east; hot and sultry weather in the centre; and fine, with occasional thunder squalls, in the north. The moist, strong air current of the South-west monsoon takes place about the middle of the month, with considerable irregular disturbance, severe squalls, and heavy rain, over the south part; the disturbed area advancing northward, and showers and rain squalls become frequent over all parts. These conditions prevail till the end of the month, when the monsoon is established.

July.—In the south and centre of the bay the weather is generally fine, with strong winds, considerable cloud, and occasionally interrupted by rain squalls; but in the northern part it is more uncertain, varying between fine weather, with lightly clouded skies, and stormy weather with severe westerly squalls, and hurricane winds near the centres, and southward, of the violent cyclonic storms of the month.

August.—This month is practically identical with July. The skies are more or less continuously clouded over all parts of the bay, with occasional rain squalls, particularly off the Coromandel and Burma coasts.

September.—Generally similar to July and August; isolated squalls, of occasional occurrence all over the bay, are most frequent on the Arakan and Tenasserim coasts.

October.—This month is very variable; the finest weather prevailing frequently for considerable periods, in the centre and north, while occasionally the largest and most severe cyclones of the year form, and blowing with hurricane force, cause a dangerous sea. Light airs and calms, with cloudy, showery weather, generally in the southern part, and prolonged intervals of fine clear weather, in the north and centre of the bay.

Wind charts, Atlantic, Indian, and Pacific oceans, 2931-2934.

November.—Generally fine throughout the greater part of the bay, except where disturbed by cyclonic conditions; showery and squally weather in the south.

December.—The month is fine as a rule over the centre and northern parts of the bay, but is somewhat unsettled in the extreme south, where occasional heavy rains and cyclonic conditions are encountered.

CYCLONES.—Cyclonic storms, an invariable characteristic of which is that in the northern hemisphere the wind blows round the area of lowest pressure in the opposite direction to the hands of a watch, and which ordinarily have in addition a progressive movement, are usually generated in the Bay of Bengal during the changes of the monsoons.

Occasionally, about May, cyclones of considerable intensity (or cyclonic storms) develop in the bay and move westward, usually northwestward; and about October, as the South-west monsoon gives way to the North-east monsoon, cyclones of very great intensity form in the bay, and are also propagated westward or north-westward. In both cases the areas exposed to their influence experience very bad weather, with rain and wind of hurricane force in the October cyclones.

Cyclonic storms of less force, but generally of greater area than those occurring at the changes of the monsoons, are most common during the South-west monsoon. These sometimes develop great force, but usually attain only the strength of a gale; they have no calm centre, and are felt as partially revolving storms at the head of the bay, their influence further southward resulting in an increase in the force of the South-west monsoon. The main characteristics of these storms is comparatively small force of wind and torrential rain.

Cyclones of great violence are comparatively rare in the Bay of Bengal, an average of two occurring in each year; but there are sometimes four or five moderate cyclones in a month.

The area over which these storms extend varies from 20 miles to some hundreds of miles in diameter, the wind blowing with an ever-varying force, sometimes lulling into little more than a strong breeze, and as the centre is approached often rising into a blast of irresistible fury. One semicircle of the storm is known as the dangerous semicircle, because a vessel in it may possibly be driven across the path of the storm, and if running before the wind would certainly cross its path. The right hand is the dangerous semicircle in the northern hemisphere.

The following information, regarding cyclonic storms in the Bay of Bengal, is taken from the Meteorological Atlas of the Indian seas:—

No storms of any consequence are recorded for the months of January, February, and March, and it would appear that in April they are of comparatively rare occurrence, but when experienced they

Wind charts, Atlantic, Indian, and Pacific oceans, 2931-2934.

have generally formed in the southern part of the bay, or near the Andaman islands, and are more probable in the latter part of the month, on the partial or irregular advance of the South-west monsoon.

Their general direction is to the northward, striking any part of the coast; one, recorded in 1895, originated in the southern part of the bay, and, taking a north and north-east course, passed over the Arakan coast, near Akyab.

May.—Cyclonic storms are a characteristic feature of this month, those in the early part forming in the southern part of the bay, or near the Andaman islands, while those later may originate in any part, but more often in the northern half. Their direction is anything between west and north-north-east.

June.—Nearly all storms develop near the head of the bay, northward of lat. 18° N., in this month, moving north-westward across the Orissa coast of Bengal.

July.—During this month storms only occur in the northern part of the bay, forming generally northward of lat. 20° N., but they are of comparatively frequent occurrence, averaging two or three every year; their direction is in general more to the westward than in June.

August.—About the same average number of storms occur in this month as in July, and the locality of origin is also about the same.

September.—Storms form somewhat further south in this month, generally northward of lat. 16° N., and their direction is more irregular than in either June, July, or August; they average about two every year.

October.—This is the most dangerous month in the bay, as storms may occur in any part, but usually originate near the centre: their direction is varied, and they have a tendency to curve. As a general rule those forming west of long. 90° E. pursue a west-north-west, a north-west, or a northerly track, while those originating eastward of that meridian probably curve from north-west, by north, to north-east.

Two severe and very remarkable storms are recorded in the years 1901 and 1907. The first, known as the Port Blair cyclone, which was northward of Borneo on October 22nd, passed close southward of Cambodia point, across the Gulf of Siam and the Malay peninsula, northward of Salang island, from which its track was over Great Andaman island and the Bay of Bengal until the meridian of 90° E., where, in about lat. 14° N., it commenced to curve to the northward, and, in about long. 87° E., to the north-eastward, up the north-west coast of the bay, arriving at its head on November 7th.

Wind charts, Atlantic, Indian, and Pacific oceans, 2931-2934.

The track of the storm of October 15th to 25th, 1907, appears to be almost parallel throughout to the preceding, and from 250 to 300 miles farther to the southward.

November.—Cyclonic storms are sometimes nearly as frequent in this month as in October, and form in any part; those originating south of lat. 12° N. have a westerly direction towards the Madras coast.

December.—The occurrence of storms in this month is exceptional, but those that form do so in the extreme south, and have a north-west or north direction, curving to the north-eastward; there is no record of them originating near the Andaman islands in this month.

Storms that have occurred in the Bay of Bengal during the period 1877 to 1903:—

	April.	May.	June.	July.	Aug.
Number of storms of great intensity	1	8	4	4	2
Number of storms of moderate intensity	3	5	25	40	38
	Sep.	**Oct.**	**Nov.**	**Dec.**	
Number of storms of great intensity	6	8	17	6.	
Number of storms of moderate intensity	43	30	8	3	

BAROMETER.—In the Bay of Bengal the movements of the barometer, indicating changes of weather, are comparatively small, a fall of three-tenths of an inch below the average for the place and time of the year occurring only before very disturbed weather, and this is not greatly exceeded except in nearly the centre of cyclonic storms.

Barometric pressure is highest across the Bay of Bengal in December and January, being about 30·05, but in February it begins to lessen, and is 29·85 in April and 29·60 in July; it commences to increase in August.

On account of the slight movement of the barometer preceding bad weather, it is necessary to allow for the diurnal variations of pressure before attempting to predict changes; these variations, in the Bay of Bengal, are remarkably regular, and are somewhat larger in the North-east than in the South-west monsoon.

The highest points occur twice daily, viz., at about 9h. 30m. a.m. and 10h. 0m. p.m.; and the lowest at 4h. 30m. p.m. and 3h. 30m. a.m.

The average rise and fall during the North-east monsoon are:—

Rise from a.m. lowest to a.m. highest, 0·08 of an inch.

Fall from a.m. highest to p.m. lowest, 0·09 of an inch.

Rise from p.m. lowest to p.m. highest, 0·07 of an inch.

Fall from p.m. highest to a.m. lowest, 0·06 of an inch.

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During the South-west monsoon:—

Rise from a.m. lowest to a.m. highest, 0·07 of an inch.

Fall from a.m. highest to p.m. lowest, 0·08 of an inch.

Rise from p.m. lowest to p.m. highest, 0·06 of an inch.

Fall from p.m. highest to a.m. lowest, 0·05 of an inch.

To reduce the barometric reading to temperature 32° F., the following are corrections for temperature of attached thermometer:—

Between	61°	and	64°	subtract	0·09″
„	65°	„	68°	„	0·10″
„	69°	„	72°	„	0·11″
„	73°	„	76°	„	0·12″
„	77°	„	80°	„	0·13″
„	81°	„	84°	„	0·14″
„	85°	„	88°	„	0·15″
„	89°	„	92°	„	0·16″
„	93°	„	96°	„	0·17″
„	97°	„	100°	„	0·18″

Indications.—The indications of the approach of a cyclonic storm are:—An unsteady barometer, or even a cessation in its usual diurnal range; an ugly and threatening appearance of the weather, and the increasing number and severity of the gusts with the freshening of the wind; a long heavy swell or confused sea, which generally comes from the direction in which the storm is approaching.

The earliest indications of the approach of a cyclonic storm in the Bay of Bengal are not given by the barometer, unless in the area where the storm is in course of formation.

Before the False point cyclonic storm of September 22nd, 1885, in which the barometer fell to the lowest point recorded in the Bay of Bengal, the barometer did not begin to fall sensibly until 10½ hours before the central calm passed over the signal station; but the weather assumed a threatening appearance 4 hours before the barometer began to fall, the wind being from north-east and blowing in fresh squalls, with an overcast sky, and heavy banks of clouds coming from the north-eastward.

In front of the storm's path, the first signs of its approach are a still, oppressive atmosphere, and if it is travelling north-westward, which is a usual course, light variable winds from between north and east, a strong westerly current across the head of the bay, and a long south-easterly swell.

Light wisps of cirrus clouds move from the south-west, gradually thickening to a sheet of cirro-stratus, and the moon, when visible, is surrounded by a luminous halo. A ruddy glow is observed, especially at sunrise, and a low bank of clouds on the south-eastern horizon is lighted at night by distant lightning. Water-spouts sometimes form

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in the still, vapour-charged atmosphere before it is stirred by an indraught towards the advancing vortex.

As a rule the barometer does not begin to fall steadily until the force of the wind is between 6 and 8, and the centre of the storm is distant from 100 to 200 miles; the barometer then continues to fall slowly until the centre is from 50 to 20 miles off, and when the wind reaches force 12 the fall is very rapid until the centre has passed.

No positive rule can be given as to the amount of depression to be expected, but at the centres of some storms the barometer stands fully 2 inches lower than outside the storm field.

The barometer rises in the rear of the storm similarly to the manner that it falls in front of it, rapidly near the centre, and gradually beyond; sometimes the rise in the rear is slower than the fall in front. The weather in the front, however, is very different from that in the rear; in front, beyond about 200 miles from the centre, the weather is fine, often calm and sultry, and no bad weather is experienced until the centre of the cyclone is within 200 miles. In the rear the weather is squally and rainy for 400 to 500 miles from the centre, southwesterly winds prevailing southward, and a southerly to south-easterly gale far eastward of the vortex.

It is difficult to estimate the distance of the centre of the vortex from the vessel, partly from the uncertainty as to the relation between the bearing of the centre and the direction of the wind, but principally from there being no means of knowing whether the storm is of large or small dimensions. If the barometer falls slowly, and the weather gets worse gradually, it is reasonable to suppose that the centre is distant; and, conversely, with a rapidly-falling barometer and bad weather increasing quickly, the centre may be supposed to be dangerously near.

Bearing of centre.—The wind in cyclonic storms blows in spirals towards the centre of the storm.

Northward of lat. 15° N. in the Bay of Bengal, when within the influence of the storm, the bearing of its centre is about 11 points to the right of the direction of the wind, and about 10 points when within 50 miles of the centre.

Southward of lat. 15° N., the bearing of the centre is about 11½ points, in the outer part of the storm, to 10 points near the centre, to the right of the direction of the wind; and off the coast of Ceylon as much as 12 to 10 points respectively. When on the outer edge of the storm, say 500 miles from the centre, there may be an error of from one point to two points in the assumed direction of the centre, obtained by applying the above rule; but as the wind increases in force the rule becomes more exact, although owing to local irregularities there may be an error of about a point in the assumed direction when within 50 miles of the centre.

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Rules for avoidance.—Constantly watch for the premonitory signs, *and carefully observe and record the barometer.*

When there is reason to believe that a cyclonic storm is approaching, the two points necessary for the seaman to know are:—the direction in which the centre of the storm is situated, and in which semicircle the vessel is situated.

In order to ascertain these two points it is essential that the observer should be stationary; the first thing, therefore, to be done is to stop, keeping head to wind, or heave-to, and as it should be assumed that the vessel is in the dangerous semicircle, heave-to on the starboard tack. There should be no hesitation in stopping or heaving-to, as an early knowledge of the position of the ship in the storm is very desirable. When stopped or hove-to, face the wind and ascertain the bearing of the centre as before directed.

Having ascertained the bearing of the centre, the semicircle in which the vessel is situated is found by observing the direction in which the wind shifts. If it shifts to the right, the vessel is in the right-hand semicircle; if to the left, in the left-hand semicircle; and if the wind is steady in direction, but increasing in force, with a falling barometer, the vessel is in the direct path of the storm.

If an observer has reason to think that he is in the direct path of the storm, the best course is to run with the wind on the starboard quarter until the barometer has ceased to fall.

If the vessel is in the right-hand semicircle, remain hove-to on the starboard tack, as the wind will constantly draw aft until the barometer begins to rise.

If in the left-hand semicircle, run with the wind on the starboard quarter until the barometer begins to rise.

General remarks.—When running up the Bay of Bengal with a strong south-west wind, occasional squalls and rain, and a slowly-falling barometer, bad weather prevails somewhere to the northward.

Between the beginning of June and the middle of September the storm centre is probably northward of lat. 16° N., and in July or August still further northward, and a sailing vessel should steer eastward and take advantage of the southerly and south-easterly winds on the eastern side of the storm as it moves north-westward. But should the weather get rapidly bad, and the barometer continue to fall, then heave-to, and determine the position with regard to the movement of the storm before proceeding.

In May, October, or November the storm travels in some direction from west, through north, to north-east; and its course should be definitely ascertained before any attempt is made to round its eastern side, as if it is moving north-eastward such a proceeding would be attended with danger.

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When leaving the Húgli from June to September notice of the approach of a cyclonic storm, or of the existence of a storm in the northern part of the bay, is given by easterly winds and a falling barometer, or by the storm signals at the telegraph stations. In July or August the storm will probably be of moderate force, although not invariably so, but in June and September some most violent cyclones have visited the coasts of Bengal and Orissa. As a vessel standing southward would most likely run into the storm, the river should not be left until the weather has moderated.

In May, October, or November a squally easterly or north-easterly wind driving low, long-drawn masses of cloud before it, or a strong westerly current at the head of the Bay of Bengal, indicate that a cyclonic storm is in the northern part of the bay, and a vessel should not proceed southward until finer weather prevails.

But in these months a cyclonic storm may be far down the bay, and at the Húgli river, or other port at the head of the bay, there may be every appearance of fine weather. With these conditions, on the first indications of the coming storm the changes of the wind and barometer should be carefully watched, and the course of the storm, if possible, be determined.

If in the right-hand semicircle the vessel should be hove-to on the starboard tack until the storm has passed, and if undoubtedly in the left-hand semicircle should heave-to on the port tack if the wind is eastward of North, or run southward, keeping the wind on the starboard quarter, when the wind is North, or westward of North.

Vessels lying in the roadsteads of the Coromandel coast on the approach of a cyclonic storm usually run southward round the south-western quadrant, and this is probably the only course open to sailing vessels; but full-powered steamers leaving while the centre is still more than 100 miles distant, and the wind between north and north-north-west, might if necessary proceed north-eastward, if it has been ascertained that the storm is not moving north-westward or northward of that.

Vessels leaving Rangoon or Moulmein, and encountering strong north-easterly winds, with a falling barometer, denoting the existence of a cyclonic storm eastward of the Andaman islands, should delay their departure until the storm has passed, which is indicated by a rising barometer, and the wind shifting to East or southward of East.

STORM SIGNALS.—The under-mentioned storm signals, known as the extended system, and adopted at all the ports of British India with the exception of those in Húgli river (page 301) are shown at the following ports in the Bay of Bengal:—Pamban; Negapatam, Cuddalore, Madras, Masulipatam, Cocanada, Vizagapatam, Kalingapatam, Gopalpur, Puri, False point, Chandbali, Balasore, Calcutta, Narayanganj, Chittagong, Akyab, Bassein, Rangoon, Moulmein, Tavoy, and Mergui.

Day signals.—Cautionary signal.—The International code square flag W, hoisted at the storm signal staff, indicates the existence of disturbed squally weather in the Bay of Bengal, which may be the first stage in the formation of a cyclonic storm, and which, if it develops, is likely to affect that part of the coast on which the port where the signal is shown is situated.

If the disturbed conditions pass away without developing into a cyclonic storm, the cautionary signal is hauled down. If, however, the disturbed weather is probably the first indication of the formation or approach of a cyclonic storm, signals indicating the probable position, character, and track of the storm are shown as follows:—

Warning signal.—A ball indicates that a cyclonic storm has formed which will probably advance to that part of the coast on which the port where the signal is shown is situated, but is still at a considerable distance from it.

The port officers, when instructed to hoist the warning signal, are also informed of the object of the signal, so as to communicate its full purport to masters of vessels about to leave the port.

Danger signals.—A cone, point downwards, indicates that a cyclonic storm, probably of little or moderate intensity, is affecting the port, and that its centre will probably cross the coast considerably southward of the port.

A cone, point upwards, indicates that a cyclonic storm, probably of little or moderate intensity, is affecting the port, and that its centre will probably cross the coast considerably northward of the port.

A drum indicates that a cyclonic storm, probably of little or moderate intensity, is affecting the port, and that its centre will probably cross the coast over or near the port.

Great danger signals.—A cone, point downwards, over a ball, indicates that a cyclonic storm of great intensity is affecting the port, and that its centre will probably cross the coast considerably southward of the port.

A cone, point upwards, over a ball, indicates that a cyclonic storm of great intensity is affecting the port, and that its centre will probably cross the coast considerably northward of the port.

A drum, over a ball, indicates that a cyclonic storm of great intensity is affecting the port, and that its centre will probably cross the coast over, or near, the port.

Night signals.—Cautionary signal.—None.

Warning signal.—A *red* light indicates that a cyclonic storm has formed, which will probably advance to that part of the coast on which the port where the signal is shown is situated, but is still at a considerable distance from it.

Danger signals.—A *red* light *placed vertically* over a *white* light indicates that a cyclonic storm, probably of little or moderate intensity, is affecting the port, and that its centre will probably cross the coast considerably southward of the port.

A *red* light *placed vertically* below a *white* light indicates that a cyclonic storm, probably of little or moderate intensity, is affecting the port, and that its centre will probably cross the coast considerably northward of the port.

Two *red* lights *placed vertically* indicate that a cyclonic storm, probably of little or moderate intensity, is affecting the port, and that its centre will probably cross the coast over, or near, the port.

Great danger signals.—Two *red* lights over a *white* light, *placed vertically*, indicate that a cyclonic storm of great intensity is affecting the port, and that its centre will probably cross the coast considerably southward of the port.

A *white* light over two *red* lights, *placed vertically*, indicate that a cyclonic storm of great intensity is affecting the port, and that its centre will probably cross the coast considerably northward of the port.

Three *red* lights *placed vertically* indicate that a cyclonic storm of great intensity is affecting the port, and that its centre will probably cross the coast over or near the port.

WEATHER SIGNALS.—For the purpose of indicating the weather in the Bay of Bengal the bay is divided into four sections, thus:—Section 1, between lat. 13° N. and lat. 19° N., and eastward of long. 90° E.; section 2, northward of lat. 19° N.; section 3, between lat. 13° N. and lat. 19° N., and westward of long. 90° E.; section 4, southward of lat. 13° N.

The upper flag indicates the weather in section 1; the second flag in section 2; the third flag in section 3; and the fourth flag in section 4.

As the different flags are shown, the answering pennant of each vessel should be hoisted, and as each flag is hauled down the answering pennant should be dipped, but not lowered altogether until the signal has been completed.

International code flag—

B. Fine weather; light or moderate winds of about usual direction for the season; calm or slight sea.

C. Fine weather; moderate to strong winds of about usual direction for the season; probably slight to moderate sea.

D. Fine weather; strong winds of about usual direction for the season; probably moderate to rough sea.

F. Fine weather; light or moderate winds of rather abnormal direction; calm or slight sea.

G. Fine weather; moderate to strong winds of rather abnormal direction; probably slight to moderate sea.

H. Fine weather; strong winds of rather abnormal direction; probably moderate to rough sea.

J. Fine weather; light or moderate winds which apparently form part of a whirl or cyclonic wind system; calm or slight sea.

K. Fine weather; moderate or strong winds which apparently form part of a whirl or cyclonic wind system; probably slight to moderate sea.

L. Doubtful weather; strong winds which apparently form part of a whirl or cyclonic wind system; probably moderate to rough sea.

M. Unsettled and suspicious weather; light or moderate winds of rather abnormal direction; calm or slight sea.

N. Unsettled and suspicious weather; moderate to strong winds of rather abnormal direction; probably slight to moderate sea.

P. Unsettled, suspicious, and probably squally weather; strong winds of rather abnormal direction; probably moderate to rough sea.

Q. Unsettled and suspicious weather; light or moderate winds which apparently form part of a whirl or cyclonic wind system; calm or slight sea.

R. Unsettled and suspicious weather; moderate to strong winds which apparently form part of a whirl or cyclonic wind system; probably slight to moderate sea.

S. Unsettled, suspicious, and probably squally weather; strong winds which apparently form part of a whirl or cyclonic wind system; probably moderate to rough sea.

T. Unsettled and suspicious weather which it is expected may lead to the formation of a cyclonic storm in the section of the bay referred to; moderate to strong winds.

V. Conditions indicate that a small storm, at present of little intensity, has formed or is forming in the section of the bay referred to; strong winds.

W. Conditions indicate that a cyclonic storm has formed in the section of the bay referred to, and has commenced to move from the place of formation; strong winds.

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CURRENTS.—As knowledge of oceanic circulation increases, it becomes more and more apparent that the currents are very variable both in rate and direction; and that even the most marked and permanent of them run in streaks which sway about in their course, producing great variations within a few miles, or at short intervals of time. The broad drift currents formed by the influence of the

Monthly current charts for the Indian ocean, 2939-2950.

winds, which produce the more rapid and well-defined stream currents, naturally vary even more.

Ceylon.—The position of the island of Ceylon is a meeting, or dividing, point for the Oceanic current systems of the Indian Ocean, the Arabian Sea, and the Bay of Bengal; and this fact probably accounts for the very varying reports, given by vessels approaching the island from all positions, as to their direction and velocity.

When within from 12 to 15 miles of the coast, or within the 100-fathoms contour line, the currents are very variable, and on the eastern and western sides of the island currents may be met with running parallel to the coast, but in diametrically opposite directions, at the same time and within a few miles of each other, but it would appear that the coast currents generally circulate round the island in the direction of the hands of a watch, during the North-east, and in a contrary direction during the South-west, monsoon, being variable at the changes.

The following table shows the approximate direction and rate in knots of the currents on the several coasts of Ceylon for each month of the year:—

Coast.	Jan.	Feb.	Mar.	April.	May.	June.
South-West	N.N.W.	N.W.	N.W. 10—25	Vble.	Vble.	Vble.
South	W.S.W. 15—55	West 10—60	W.S.W. 15—60	West 10—50	E.N.E.	East 10—55
East....................	S.S.E. 15—50	N.N.W. 15—30	S.W. 15—45	N.N.W. 15—35	South	S.E. 10—45
North-East	S.E. 10—50	N.W. 15—45	N.N.W. 15—60	W.N.W. 10—40	North	N.W. 10—40

Coast.	July.	Aug.	Sep.	Oct.	Nov.	Dec.
South-West	—	S.E. 0—35	N.N.W.	N.N.W. 0—20	Vble.	S.W. 10—55
South	East 10—70	East 10—65	East 15—75	E.S.E. 10—40	W.S.W. 15—95	West 10—85
East....................	S.S.E. 10—40	E.N.E. 10—65	S.S.E. 15—75	S.S.E. 20—90	South 10—70	S.W. 15—80
North-East	S.E. 10—45	S.S.E. 10—35	North	South 10—40	S.E. 10—70	S.E. 15—80

Bay of Bengal.—January.—Over the Bay of Bengal, and the sea to the southward, the general set is to the south-west and west, but along the Coromandel coast, the set is to the southward, at rates of from 10 to 60 miles in twenty-four hours.

February.—In this month the currents show a complete circulation, the set being to the north and north-east, along the Madras and Orissa coasts; to the east and south-east across the head of the bay; to the south and south-west on the east coast; and to the westward in the south and centre. The velocity is greatest along the Madras coast,

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where the northerly set is strong, the rates being from 10 to 60 miles in twenty-four hours.

March.—From Ceylon the current runs in a north and north-east direction up the Madras coast so far as Gopalpur, and then turns to the eastward and sets across the north side of the bay, finally covering its east side as a south-east to south-west current. In the centre of the bay, between the 13th and 17th parallels, the current is irregular.

April.—There is a fairly regular circulation in this month, as in March, the current running to the northward up the west side; to the eastward near the head, and down the east coast to the southward. Over the centre of the bay the currents are irregular and weak.

May.—The currents are irregular, with very little movement near the Madras coast, but farther out on the west side, and near the Andaman islands, there is a fairly general and strong set to the north-east.

June.—The set is to the north-east and east over the west and north parts of the bay, but over the east and centre the currents are complicated and weak in places.

July.—The currents are also unsteady and complicated in this month; the northerly set up the Madras coast only extends so far as lat. 16° N., where it is met by a south-east current.

August.—The currents are again irregular, but generally the set is to the north-east; off the southern part of the Coromandel coast the set is south, and off the Orissa coast, south-west.

September.—An easterly set is general across the southern part of the bay, but in the bay itself the movement is irregular. A northerly current is found off the Madras coast, a south-west set on the Orissa coast; it is generally to the eastward in the centre of the bay, but very complex about the Andaman islands.

October.—The currents are confused, with no regular movement in the centre of the bay, but in other parts there is a circular movement, which is in a contrary direction to that described for April; the velocity is moderate to strong, in the north and west, but generally weak elsewhere.

November.—There is more regularity in this month than in the preceding one, there being a general set to the east, south-east, and south over the surface of the bay, the most regular currents are those that set south-west and south off the Madras and Orissa coasts.

December.—The currents are somewhat complicated over the Bay of Bengal during this month, although there is a general movement of the water to the west, south-west, and south; the strongest is that to the southward along the Madras coast.

The currents given for the Bay of Bengal in the following table can only be regarded as approximate, both in direction and rate;

Monthly current charts for the Indian ocean, 2939-2500.

when the latter is 10 knots or more daily, it is probable that some current in the direction given will be experienced, but with the minimum rate zero, its direction may even be reversed.

Lat.	Jan.	Feb.	Mar.	April.	May.	June.
West Coast:—						
8°—12°	S.W. 10—35	North 10—40	N.N.W. 15—40	North 10—45	North 15—45	N.N.W. 10—40
12°—16°	Vble.	N.N.E. 15—50	North 15—55	North 15—80	N.N.E. 20—60	N.N.E. 10—40
16°—20°	Vble.	N.E. 15—50	N.E. 10—55	N.N.E. 10—70	Vble.	N.E. 15—35
20°—24°	Vble.	East 10—40	S.W.	—	Vble.	N.E. 10—45
Head of Bay	South	S.E. 10—40	N.E. 10—20	N.E. 10—30	N.E. 15—50	N.E.

Lat.	July.	Aug.	Sep.	Oct.	Nov.	Dec.
West Coast:—						
8°—12°	Vble.	Vble.	N.E. 10—35	S.W. 10—20	South 10—60	South 10—50
12°—16°	North 10—25	N.E. 10—50	N.E.	South 10—40	South 10—70	South 10—50
16°—20°	E.N.E. 10—50	N.E.	S.W.	S.W. 10—35	S.W. 10—45	S.W. 10—40
20°—24°	S.W.	S.W. 15—40	S.W. 10—40	S.W. 20—45	S.W. 0—40	—
Head of Bay	S.W.	N.N.E. 10—25	W.S.W.	West 10—35	W.S.W. 10—40	S.W. 10—40

Lat.	Jan.	Feb.	Mar.	April.	May.	June.
East Coast:—						
20°—24°	—	South 10—20	—	—	—	—
16°—20°	South	S.E. 15—30	S.E. 0—30	S.E. 10—20	N.N.W.	N.E.
12°—16°	S.S.W. 10—25	S.W. 10—25	Vble.	S.S.E. 10—25	N.N.W.	Vble.
8°—12°	West 20—40	S.W. 10—25	Vble.	N.N.W. 10—30	East	N.N.E. 15—45
Centre of Bay	S.W. 0—30	West 15—30	S.W. 10—30	West 10—40	Vble.	Vble.

Lat.	July.	Aug.	Sep.	Oct.	Nov.	Dec.
East Coast:—						
20°—40°	—	—	—	—	S.W.	—
16°—20°	N.N.W	—	N.W.	West	W.S.W. 10—45	Vble.
12°—16°	N.N.W.	Vble.	S.S.E.	West 15—40	West 10—35	S.E.
8°—12°	South	South	S.E. 10—35	S.S.E. 10—30	West	N.W. 10—35
Centre of Bay	N.E.	N.E. 10—35	East 10—40	Vble.	West 10—35	West 10—35

TIDES.—The tidal wave appears to propagate itself in a northerly direction into the Bay of Bengal; then, expanding, it produces high water between 8h. 26m. and 9h. 45m. at full and change on the eastern coast of India, and generally between 10h. 0m. and 10h. 30m. at full and change on the eastern shore of the bay southward to Salang island.*

At Colombo four floods and four ebbs have been observed in the course of 25 hours, the difference between high and low water being only 6 inches. This may be attributed to the bifurcation of the ocean tidal wave at the Maldive group, which has the same effect as a continent interposing.

On the coast of Ceylon it is high water at Pamban, Colombo, and Galle at 1h. 48m., 1h. 50m., and 2h. 3m. respectively; at Kirindi, on the south-east coast, high water occurs 1½ hours later; at Batticaloa 3 hours later; and at Trincomalí 7½ hours later than at Galle, the tidal rise being 2 to 3 feet.

If the times of high water at different places on the shores of the bay be reduced to the standard time of Madras, it will be seen that high water occurs almost simultaneously at all the places situated near deep water, except on the east coast of Ceylon.

On the eastern coast of India the tidal rise at springs is, at Madras, 3½ feet; at Cocanada, 5¼ feet; at False point, 7 feet; at Eastern channel light-vessel, 10¾ feet; and at Sagar island, at the mouth of the Húgli river, 15¾ feet.

At the mouth of Karnaphuli river, in the north-eastern part of the Bay of Bengal, where the tidal wave is retarded owing to the shallow water in its vicinity, the rise is about 15 feet, and time of high water, full and change, is 0h. 30m.

On the eastern shore of the bay, southward to Bassein river, at positions not complicated by an extensive off-lying bank of soundings, the tidal rise at springs is 7½ to 10 feet. In the Gulf of Martaban, where the water is shoal, the time of high water becomes later, it being high water, full and change, at China Bakír lighthouse at 3h. 3m., and at Amherst at 2h. 21m.; and the tidal rise increases, it being 16 feet at China Bakír lighthouse, and 20 feet at Amherst at springs.

Throughout the Nicobar and Andaman islands the time of high water varies from 8h. 26m. to 10h. 24m., and the rise at springs between 5 and 9¼ feet.

Along the Tenasserim coast, at the entrance of the Tavoy river, where comparatively shoal water extends some distance from the land, the spring rise is 15½ feet; in Mergui harbour, about 18 feet; and at

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* Tide tables for the principal Indian ports, as calculated by harmonic analysis, are published annually by the Indian Government.

Hastings harbour, 14 feet; but at Salang island, situated about 135 miles farther southward, where deep water is closer to the coast, the spring rise is 9 feet.

Between Malacca strait and Nicobar islands there are occasionally lines of heavy overfalls, which sometimes have the appearance of breakers.

Diurnal inequality.—The tides in the Bay of Bengal are largely affected by diurnal inequality, both of time and height.

The only general rule that can be given with regard to the principal inequalities of height is that the day tides are highest when the sun has north declination, and the night tides when the sun has south declination; this is more decidedly apparent at springs, but is not invariably the case at neap tides.

In the northern parts of the Bay of Bengal, as well as on the Martaban and Tenasserim coasts, the diurnal inequality may either accelerate or retard the times of high and low water to the amount of nearly an hour, and increase or diminish the rise by upwards of a foot.

THE BORE.—No accurate observations have been made on the bores of the river mouths on the northern and eastern shores of the Bay of Bengal. These bores only occur at springs or other unusually high tides, and generally speaking the height of a wave in the navigable channels is not such as to affect a ship, though small craft keep out of its way, or move off the shallows into the deeper water.

The best known of these bores are those of the Húgli and the Meghna, of Bengal; and the Pegu, and, especially, Sittang river, of Burma. They mainly occur during the South-west monsoon; but should the moon be in perigee at full or change, or other seasons, bores may then form.

MUD VOLCANOES.—A particular feature of the Arakan coast is the number of mud volcanoes discharging marsh gas and sometimes flames, which occur, not only on the mainland and the islands adjacent to it, but also in the sea in their vicinity, these latter constituting a serious danger to navigation, as they apparently happen in any part, although certain areas, probably governed by local lines of fault, seem to be more liable to them than others, and of these the neighbourhood of the Terribles and Chedúba and Foul islands may be mentioned.

On the last-named island an extensive eruption took place in February, 1908, which was described as a lurid flame rising to a height of about 500 feet, lasting for about a quarter of an hour, and followed by an explosive puff and a small flame, which soon died out.

Mud volcanoes, which occur in the sea, frequently raise islets, which may remain above water for some time, or quickly sink, leaving dangerous shoals in their places, and a constant and careful lookout is necessary when navigating this coast.

Chart 2930, Mean surface temperatures.

THE SURFACE TEMPERATURE of the sea in the Bay of Bengal is highest in May and lowest in February, the annual variation being about 3° in the southern part of the bay, and 8° in the northern part.

In February the average temperature is 82° between Ceylon and the Nicobars, gradually decreasing towards the head of the bay to 77°. In the sea eastward of the Andamans the temperature in this month is 80°.

In May the average temperature of the surface water over the Bay of Bengal is 84° to 86°. A temperature of 87° is attained between Ceylon and the Nicobars; and 82° between the north end of Ceylon and Madras.

In August the average mean temperature of the surface water of the bay is 82° to 83°; and it is the same in November.

Chart 70, Bay of Bengal.

SOUNDINGS.—On the south and east coasts of Ceylon the 100-fathoms contour line is about 10 miles off-shore, but deep, narrow guts approach the east coast in places, and throughout, where examined, the bank has a strongly marked and remarkably steep edge.

On the greater part of the coast of the Bay of Bengal the 100-fathoms contour line is not defined, but from Madras northward as far as the mouth of the Penner river its distance from the coast is from 10 to 15 miles, increasing to 30 miles off Mutapoli bank, and then resuming distances somewhat the same as the former as far as Cocanada.

Off the coast between Cocanada and the outlet of Chilka lake its general distance from the shore is 25 miles, but across the head of the bay and as far south on the east coast as The Terribles it is not defined; from The Terribles to St. Johns rocks it is from 30 to 35 miles off-shore.

Chart 2937, Oceanic soundings, sheet II.

Deep soundings.—South of Ceylon and on a line across the mouth of the Bay of Bengal, until nearing the north-west end of Sumatra, the depths are over 2,000 fathoms.

Eastward of Calimere point, and off the coast to the northward for a distance of about 200 miles, the depths are about 1,900 fathoms, from which they gradually decrease to the northward. The line of depth of 1,000 fathoms probably crosses the bay at about 150 miles from its head.

On the east coast of the bay the deep soundings are less than on the west, as soundings of 1,000 to 1,200 fathoms are met with at 100 to 150 miles off-shore, shoaling again to the eastern side of the Andaman islands. Between the Nicobar islands and the coast are depths of from 1,400 to 1,600 fathoms, and in the centre of the bay the general depths are from 1,700 to 1,800 fathoms.

NAVAL DOCKYARDS AND ESTABLISHMENTS.—The naval dockyard of the Royal Indian Marine is at Kidderpur, Calcutta.

LIGHT-VESSELS.—Riding lights.—The light-vessels in Indian waters exhibit the usual anchor *white* light on the forestay for the purpose of indicating the direction in which the vessel is riding.

Chart 1188, Coal and telegraph.

COAL.—The following are coaling stations where more than 500 tons of coal are kept in stock:—Colombo, Galle, Kankesanturai, Pondicherri, Madras, Calcutta, Chittagong, Akyab, and Rangoon. Less than 500 tons are kept at Cocanada, Moulmein, and Bassein; some coal is also kept at Negapatam, but its supply to vessels is uncertain.

DOCKS.—There is a graving dock at Colombo and several docks at Calcutta; the dimensions and docking facilities are fully given in the Appendix, pages 565, 566.

There are patent slips at Colombo, Calcutta, and Rangoon; their dimensions will also be found in the Appendix, pages 565, 566.

REPAIRS.—Large repairs can be executed at Colombo, Madras, Calcutta, Akyab, and Rangoon; and small repairs at Galle, Trincomalí, Negapatam, Chittagong, Port Blair, and Moulmein. *See* also the different ports.

TIME SIGNALS.—Time signals are made at Colombo, Madras, Calcutta, and Rangoon. *See* also Admiralty list of time signals.

WIRELESS TELEGRAPH STATIONS.—There are wireless telegraph stations at the Pilot vessel at the Sandheads, Húgli river, at Diamond island, Bassein river, and at Port Blair, Andaman islands.

UNIFORM SYSTEM OF BUOYAGE.—The following is the uniform system of buoyage adopted for Indian waters:—

1. When approaching the coasts, the position on the chart and the direction of the main stream of flood tide must be noted.

2. The term Starboard Hand denotes that side which would be on the starboard side of a vessel either going with the main stream of flood, or entering a harbour, river, or estuary from seaward; the term Port Hand denotes the port side of a vessel under the same circumstances.

3. Buoys showing the pointed top of a cone above water are called *Conical*, and are always Starboard Hand buoys, as above defined.

4. Buoys showing a flat top above water are called *Can*, and are always Port Hand buoys, as above defined.

5. Buoys showing a domed top above water are called *Spherical*, and mark the ends of Middle Grounds.

6. Buoys having a tall central structure on a broad base are called *Pillar* buoys, and, like other special buoys, such as *Bell* buoys, *Gas* buoys, *Automatic Sounding* buoys, &c., are placed to mark special positions, either on the coast or in the approaches to harbours, &c.

7. Buoys showing only a mast above water are called *Spar* buoys.

8. Starboard Hand buoys are always painted a single red colour.

9. Port Hand buoys are painted of another characteristic colour, either black or parti-colour.

10. Spherical buoys at the ends of Middle Grounds are always distinguished by horizontal stripes of white colour.

11. Surmounting topmarks, such as staff and cone, &c., are always painted of one dark colour.

12. Staff and Cone are only used on Starboard Hand buoys; Staff and Cylinder on Port Hand; Globes at the outer ends of Middle Grounds; and Half Globes, round part uppermost, at the inner ends.

13. Buoys on the same side of a channel, estuary, or tideway may be distinguished from each other by names or consecutive numbers or letters, commencing from seaward, and when necessary by a staff, surmounted by the appropriate topmark.

14. *Fairway* buoys are always painted in horizontal stripes of white colour, and are surmounted by a staff only.

15. Buoys intended for mooring, &c., may be of shape or colour according to the discretion of the authority within whose jurisdiction they are laid, but for marking Submarine Telegraph Cables the colour is green, with the word *Telegraph* painted thereon in white letters.

Buoying and marking of Wrecks:—

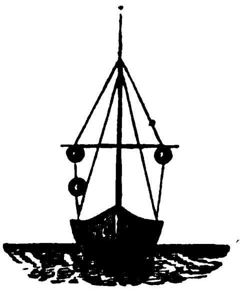
16. Wreck buoys in the open sea, or in the approaches to a harbour or estuary, are coloured green, with the word *Wreck* painted in white letters on them.

17. When possible the buoy shall be laid near to the side of the wreck next to mid-channel.

18. When a wreck-marking vessel is used she shall, if possible, have her top sides coloured green, with the word *Wreck* in white letters thereon, and shall exhibit:—

By day:—Three balls on a yard 20 feet above the sea, two placed vertically at one end, and one at the other, the single ball being on the side nearest to the wreck.

By night:—Three *fixed white* lights, similarly arranged, but not the ordinary riding light.



Pass on this side.

19. In narrow waters, or in rivers, harbours, &c., under the juris-

diction of Local Authorities, the same rules may be adopted, or, at discretion, varied as follows:—

When a wreck-marking vessel is used, she shall carry a yard on a mast, with two balls by day, placed horizontally, not less than 6 nor more than 12 feet apart, and *two* lights by night, similarly placed.

When a barge or boat only is used, a flag or ball may be shown in the daytime.

The position in which the marking vessel is placed, with reference to the wreck, shall be at the discretion of the Local Authority having jurisdiction.

Chart 2598, Curves of equal magnetic variation.

MAGNETIC VARIATION.—The curve of no variation crosses the southern part of the Bay of Bengal from the coast about 80 miles southward of Madras, curving in a south-east direction past the south-west side of the Nicobar islands; the curve of 1° W. passes through the southern part of Ceylon, and that of 1° E. close to Calcutta and the head of the bay.

The variation, for the year 1910, is given on each page for the portion of the bay described therein, and the annual changes will be found at the commencement of each chapter.

BRITISH CONSULAR STATIONS.—There is a British Consul at Pondicherri.

Chart 1077, Tracks followed by full-powered steam vessels.

PASSAGES.—FULL-POWERED STEAM-VESSELS.

—These passages are always as direct as circumstances permit.

Aden to Ceylon and Bay of Bengal.—Direct. Distance to Colombo, 2,100 miles; to Point de Galle, 2,130; to Trincomalí, 2,380; to Madras, 2,660; to Calcutta and Rangoon, 3,300. By calling at Colombo for coal, the distances to the other parts are increased by about 60 miles.

From April to October vessels should invariably pass to the northward of Sokotra, to avoid the heavy cross seas to the southward of it during the South-west monsoon, and at all seasons of the year it is advisable not to take the southern route if the Abd-al-Kuri is to be made at night, as the currents are often strong to the northward.

Bay of Bengal and Ceylon to Aden.—Direct, passing southward of Minikoi island, and pass northward of Sokotra from April to October.

If following the direct route, vessels should steer so as to pass about 40 miles northward of Sokotra, giving the east end of that island a wide berth.

The usual practice in a steamer of moderate power during the South-west monsoon is, after passing Minikoi, to keep westward in the same latitude (8° 10′ N.) to long. 60° E., and then to steer for the east end of Sokotra. By this track sail can be used from long. 60° E. to Sokotra, and the sea is not so directly ahead. It is somewhat longer, the distance from Colombo to Aden being 2,177 miles.

Certain officers in the mercantile marine, having great experience, strongly favour the route south of Sokotra and Abd-al-Kuri during the South-west monsoon, as the finer weather and smoother water experienced fully compensate for the additional 100 miles of this route over that to the northward.

From Colombo this alternative route is followed by steering so as to pass southward of Minikoi, in about lat. 7° 30′ N., crossing the meridian of 70° E. in lat. 7° 40′ N., that of 50° E. in lat. 8° 0′ N., and that of 53° 15′ E. in lat. 10° 0′ N., afterwards edging away for Cape Guardafin, which must be approached with great caution.

Australia to Colombo and Calcutta.—From the south-east and south coasts.—Direct round Cape Leeuwin. Distances:—Sydney to Colombo, 5,300 miles; to Calcutta, 5,840 miles; Melbourne to Colombo, 4,730 miles; to Calcutta, 5,270; Port Adelaide to Colombo, 4,420 miles; to Calcutta, 4,960; King George sound to Colombo, 3,380 miles; to Calcutta, 3,920.

From the north coast.—As direct as possible, passing southward of Java. Distances:—Port Darwin to Colombo, 3,340 miles; to Calcutta, 3,720; Thursday island to Colombo, 4,020 miles; to Calcutta, 4,080.

Calcutta and Colombo to Australia.—The reverse of the preceding passage.

Cape of Good Hope to Bay of Bengal.—There are two routes. One through Mozambique channel, calling at Seychelles islands for coal, thence through One and a half degree channel and round the southern side of Ceylon.

The other passes about 200 miles southward of Madagascar, calling at Mauritius for coal, and thence is direct round the south-eastern side of Ceylon.

By the first route at all seasons the wind and sea are more favourable, and consequently there is less wear and tear. Distances:—Cape of Good Hope to Trincomalí, viâ Seychelles, 4,730 miles; to Madras, 5,000; to Calcutta and Rangoon, 5,640; and viâ Mauritius, about 130 miles less.

Bay of Bengal to Cape of Good Hope.—Direct past south-eastern side of Ceylon, eastward of the Chagos group, calling at Mauritius for coal; make the African coast in about 32° S., and keep in the strength of the Agulhas current to abreast Mossel bay, thence direct round Cape Agulhas.

Distances to Cape of Good Hope:—From Calcutta and Rangoon, 5,510 miles; from Madras, 4,870; from Trincomalí, 4,600.

From Rangoon, during the strength of the South-west monsoon, or

Chart 1077, Tracks followed by full-powered steam vessels.

in June, July, and August, pass eastward of the Andamans and Nicobars, thence direct to Mauritius.

Bombay to Ceylon and Bay of Bengal.—Direct round the south end of Ceylon. Distances:—To Colombo, 900 miles; to Galle, 930; to Trincomalí, 1,180; to Madras, 1,460; and to Calcutta and Rangoon, 2,100. There is no channel between India and Ceylon, except for small vessels of not more than 11½ feet draught, through Pamban pass.

Bay of Bengal and Ceylon to Bombay.—Direct round Ceylon.

Western side of Bay of Bengal.—Direct. Distances:—Trincomalí and Madras, 280 miles; Trincomalí and Calcutta, 970; Madras and Calcutta, 780; Colombo and Calcutta, 1,220.

Calcutta and Penang.—Direct through Preparis south channel. Distance, 1,310 miles.

Ceylon or Coromandel coast and Penang.—Direct both ways. Distances:—Trincomalí and Penang, 1,150 miles; Madras and Penang, 1,280.

Calcutta and Rangoon or Moulmein.—Direct both ways. Distances:—Calcutta and Rangoon, 760 miles; Calcutta and Moulmein, 820.

Madras and Rangoon or Moulmein.—Direct both ways. Distances:—Madras and Rangoon, 990 miles; Madras and Moulmein, 1,050.

Calcutta or Madras and Mergui.—Between Calcutta and Mergui, pass through Preparis north channel; between Madras and Mergui, through Coco channel. Distances:—Calcutta and Mergui, 910 miles; Madras and Mergui, 1,080.

Chart 1078, Tracks followed by vessels with sail and low steam power.

SAILING VESSELS.—The routes followed by sailing vessels, and those with low steam power, in both monsoons, are given in the tabulated forms following, observing that in all cases the set of the currents should be considered.

Sailing passage.	During S.W. monsoon (April to September).	During N.E. monsoon (October to March).
1. CAPE OF GOOD HOPE TO BAY OF BENGAL.	Round Cape of Good Hope, run down easting in 39° or 40° S. to 62° E., then steer north-eastward to 28° S., 80° to 82° E., then northward in S.E. trade; cross equator in 82° E., thence direct to port. For Colombo keep about 4° westward of above track, and cross equator in about 77° E. *See* Remarks, page 92. LOW-POWERED VESSELS as above.	Round Cape of Good Hope, run down easting in 39° or 40° S. (or further south in January) to about 80° E., then steer north-eastward to 28° S., 85° to 88° E., thence northward, cross equator in 93° to 95° E., and pass 150 miles westward of north-western end of Sumatra. Pass westward of Nicobar and Andaman islands, whence the northern part of the Bay of Bengal is often made without tacking. In February or March keep well westward up the bay. If bound to Madras or east coast of Ceylon, shape direct course from position off Nicobar islands.

Chart 1078, Tracks followed by vessels with sail and low steam power.

Sailing passage.	During S.W. monsoon (April to September).	During N.E. monsoon (October to March).
2. Bay of Bengal to Cape of Good Hope.	From the Sandheads make for the Orissa coast, sighting the land south of False point, and working to the south-westward along the shore, make short tacks during the day and long boards off-shore during the night, bringing Kalingapatam abeam before leaving the coast and standing down the bay. A comparatively smooth sea and a favourable current will be found near the shore, and advantage may be taken of a veering wind in the squalls off the land. Cross the equator in about 95° E., keeping on tack which makes most southing into S.E. trade, when steer for Rodriguez; thence 90 miles southward of Madagascar, make the African coast in about lat. 32° S., keep in the strength of the Agulhas current to abreast Mossel bay, and then direct round Cape Agulhas. From Madras or Coromandel coast stand at once across the equator into S.E. trade, then proceed as above.	Run down the bay, and cross equator in 86° to 87° E., then steer to pass 300 miles south-eastward of Rodriguez, and thence 90 miles southward of Madagascar. Make the African coast in about 32° S., and keep in the strength of the Agulhas current to abreast Mossel bay, and then direct round Cape Agulhas.
3. Aden to Bay of Bengal.	Steer northward of Sokotra round Ceylon and direct to port. Low-powered vessels steam along the Arabian coast to about long. 52° E., and then proceed to Ceylon or up the middle of the Bay of Bengal.	Along the south coast of Arabia to about 52° E., pass through the Eight or Nine degrees channel, then steer to round Ceylon, and having passed that island, make easting on parallel of 5° N. to about the middle of the bay, and then work northward. From 87° E. a vessel will probably fetch Madras. After mid-February round Ceylon at the distance of about 50 miles, and then proceed direct. This also applies to Low-powered vessels.
4. Bay of Bengal to Aden.	Same as No. 2 into S.E. trade. Then run westward, passing southward of the Chagos group and north-eastward of the Seychelles, cross the equator in about 53° or 54° E., and make the African coast at Ras Hafún. Great caution is necessary in making the land. Round Ras Asir and work along the African coast as far as Burnt island before standing across for Aden. Low-powered vessels.—If the S.E. trade is near the equator, as it may be from June to August, westing should be made in lat. 4° to 5° S. instead of to the southward of the Chagos group.	Round Ceylon, through Nine-degree channel, and northward of Sokotra. After mid-March pass southward of Sokotra. The above also applies to Low-powered vessels.
5. S.E. Australia to Bay of Bengal.	By Inner or Outer route to Torres strait, then southward of Timor and Sandalwood islands, keep in S.E. trade till in about 85° E., then stand north-west, cross equator in about 80° E., whence direct, allowing for strong easterly current. Low-powered vessels should always take the Inner route to Torres strait.	Through Bass strait, direct for Cape Leeuwin not going southward of 40° S., then steer north-westward through the S.E. trade so as to enter the N.W. monsoon in 85° E.; then shape course toward Acheh head, and proceed westward of Nicobar and Andaman islands to destination. This track is usually taken from December to April.

Chart 1078, Tracks followed by vessels with sail and low steam power.

Sailing passage.	During S.W. monsoon (April to September).	During N.E. monsoon (October to March).
6. BAY OF BENGAL TO S.E. AUSTRALIA.	As in No. 2 until in S.E. trade, then keep on port tack, and when in the westerly winds proceed direct.	Run down the bay, cross equator in 86° E., pass through N.W. monsoon into S.E. trade, stand across the S.E. trade into the westerly winds, and then direct.
7. MALACCA STRAIT TO CALCUTTA.	Pass southward of the Nicobar islands, thence direct for the Orissa coast.	To mid-January pass eastward of the Andamans, after mid-January pass through Ten-degrees channel, or Duncan passage, and work northward in the middle of the bay.
8. CALCUTTA TO MALACCA STRAIT.	Direct through Preparis south channel.	Through Preparis north or south channel, and direct.
9. RANGOON OR MOULMEIN TO CALCUTTA	Through Preparis north or south channel, thence direct.	Round Alguada reef, thence proceed northward about 30 miles off the coast of Burma before stretching across, but after January from Alguada reef stand into middle of bay and work northward.
10. CALCUTTA TO RANGOON OR MOULMEIN	Through Preparis south channel, then steer to make China Bakir lighthouse, if bound to Rangoon, but make Double island if bound to Moulmein, allowing for tidal streams.	Round Alguada reef and work eastward, keeping the lead going and allowing for tidal streams.
11. BAY OF BENGAL TO BOMBAY.	As No. 2 into S.E. trade, run westward between lat. 8° and 9° S., passing south of Chagos islands. From 70° E. steer to cross the equator in 62° or 63° E. and thence direct. LOW-POWERED VESSELS follow the above route, but if the S.E. trade is near the equator, make westing in lat. 4° to 5° S. instead of to the southward of the Chagos archipelago.	Down the west side of the bay and at convenient distance from coast of Ceylon. After passing Cape Comorin keep in sight of the west coast of India, so as to profit by the sea breezes. Above also applies to Low-powered vessels.
12. BOMBAY TO BAY OF BENGAL.	From an offing in 15 to 20 fathoms water (or even 40 to 50 in first part of S.W. monsoon, when the wind is well southward), stand down the coast of India, round the south end of Ceylon, and thence direct.	Direct round Ceylon. Thence make easting to middle of bay, and work northward. *See* No. 3.
13. COROMANDEL COAST TO RANGOON OR MOULMEIN.	Sight Landfall island of Andaman islands if with southerly wind, or Great Coco island with westerly wind. Pass through Coco channel, thence eastward, sighting Narcondam island, and then make China Bakir lighthouse, if bound for Rangoon, or Double island if for Moulmein.	Make northing in middle of bay, pass through Preparis north or south channel, then steer to make China Bakir lighthouse, if for Rangoon, or Double island if for Moulmein, keeping the lead going and allowing for tidal streams.
14. RANGOON OR MOULMEIN TO COROMANDEL COAST.	Keep well out to sea if the wind becomes westerly, and endeavour to sight Narcondam island. In working south, keep west of and a moderate distance from the Mergui archipelago. Pass through Bengal passage, thence work westward to destination.	Pass through Preparis north channel and thence direct, making the land to the southward after January.
15. COROMANDEL COAST OR CEYLON TO MALACCA STRAIT.	Pass southward of Great Nicobar island, guarding against southerly set, thence through Bengal passage, sight Pulo Buton, and keep Malay side of strait.	If from Ceylon pass close southward of Great Nicobar island, and endeavour to close the Malay coast. If from Madras pass through Sombrero channel of the Nicobar islands.

Chart 1078, Tracks followed by vessels with sail and low steam power.

Sailing passage.	During S.W. monsoon (April to September).	During N.E. monsoon (October to March).
16. **Malacca Strait to Ceylon or to the Coromandel Coast.**	Keep near north coast of Sumatra, then through Bengal passage, and work across the bay; in the height of the S.W. monsoon, or in June, July, and August, and also when bound to Ceylon, from a good berth off Achch head cross the equator into S.E. trade, then a westerly course and re-cross the equator in about 83° E. For Colombo re-cross the equator in about 77° E.	To Ceylon pass on either side of Pulo Pera and between Pulo Rondo and Great Nicobar island, thence direct, but if westerly winds are experienced near northern end of Sumatra, which is probable in October and November, keep northward. If to Coromandel coast, keep on the Malay coast until Salang or Junkseylon island is reached, thence through either Ten-degrees or Sombrero channel (Nicobars). In December and January make the land northward of port on account of southerly set on Coromandel and Ceylon coasts.
17. **Coromandel coast or Ceylon to Calcutta.**	Direct. Keep a moderate distance from the coast, make the land about Pundi (lat. 18° 40′ N.), and use the lead. In September as in October.	Make easting across the bay, and northing on the east side or in the middle. In February and March, possibly steer direct, or stand to eastward. In October, stretch over to North Andaman island or Cape Negrais, when 100 miles westward of either, tack to north-west.
18. **Calcutta to Coromandel coast or Ceylon.**	Make southing without closing the east side of the bay. Steer for port when 60 miles southward of it. If unable to work southward, pass eastward of the Andamans and Nicobars and through Bengal passage. Thence work across the bay, but in June, July, and August, stand across the equator into S.E. trade, make westing, and re-cross the equator in about 83° E., then direct. For Colombo re-cross the equator in about 77° E.	Steer direct. In September, with light south winds, work to southwest, keeping in soundings, or stand out to sea. Give the coast a berth in February and March as the current then runs northward.
19. **Malacca strait to Rangoon or Moulmein.**	Sight Narcondam island, thence make China Bakir lighthouse if for Rangoon, for Double island if for Moulmein.	Sight West Torres island, thence make China Bakir lighthouse if for Rangoon, or Double island if for Moulmein.
20. **Rangoon or Moulmein to Malacca strait.**	As in No. 14, passing south point of Salang island, and thence direct.	Keep outside Mergui archipelago, then sight the south point of Salang island.
21. **Rangoon or Moulmein to Acheh.**	Endeavour to sight Narcondam island and get westward towards Nicobar islands, or make for the north coast of Sumatra, where the west current is favourable.	Steer direct.
22. **Bay of Bengal to Mergui.**	From the head of the bay pass on either side of the Coco islands, but if from the Coromandel coast, pass southward of Little Andaman island, thence steer for Tenasserim island.	From the head of the bay round Alguada reef, or if from the Coromandel coast pass northward of the Andaman islands. Thence work to the eastward and pass Tavoy island on either side.
23. **Mergui to Bay of Bengal.**	For the head of the bay work to the westward and pass through Coco or Preparis channels, but for the Coromandel coast when clear of island work southward to the north end of Sumatra, passing through Bengal passage, and so stand for the Coromandel coast.	Through any channel north of the Andaman islands and thence direct; but after January, if for the Coromandel coast, pass southward of Little Andaman.

Chart 1078, Tracks followed by vessels with sail and low steam power.

General rules for sailing vessels navigating the Bay of Bengal.

Time of the year.	Bound northward.	Bound southward.
From 15th January to 31st May.	Take the western side -	Take the eastern side.
In June, July, August -	Keep in the middle of the bay -	In the middle of the bay, or take the eastern side, pass eastward of the Andaman islands, and round Acheh head.
In September, October, and November.	Take the eastern side -	Take the western side.
In December and to the 15th January.	Keep the middle of the bay, and make short tacks.	Keep the middle of the bay.

Remarks.—The first outer passage, from the Cape of Good Hope to the Bay of Bengal, is taken if expecting to cross the equator from May to September, with a certainty of gaining the port before the end of the South-west monsoon.

In proceeding northward, gain easting to counteract the westerly current, and to be prepared for the wind shifting northward, for in the South-east trade it often happens, particularly in April and May, that the wind is more from east and east-north-east than from south-east. The South-east trade at this season extends to the equator, and from lat. 1° to 2° N. the South-west monsoon, between May and September, is a fair wind to Calcutta or any part of the Bay of Bengal.

The Mozambique channel, or Inner route, is the most direct for vessels to any port of India during the South-west monsoon, but it must not be taken unless there is a certainty of reaching the port before the close of the monsoon.

On leaving the Cape, if with south-easterly winds, stand southward and run down the easting in lat. 39° to 40° S. to about long. 30° E.; if with westerly winds, run along the coast, guarding against any indraught, keeping not northward of lat. 35° S. until in long. 37° E.; then steer for Mozambique channel, passing eastward of Europa island and on either side of Juan da Nova, pass through the Comoro islands, cross the equator in about long. 54° E., thence direct for the Eight-degrees channel, and round the south end of Ceylon up the bay.

November to March.—The second outer passage is taken when it is likely that the Bay of Bengal will not be reached before the South-west monsoon is over, or when expecting to cross the equator between October and April, and to arrive in the bay when the North-east monsoon has set in.

If the wind is westerly give the Nicobar and Andaman islands a good berth, but if north-easterly steer up the bay close-hauled, passing westward of the islands unless bound to ports eastward of them. In about lat. 16° to 17° N. the wind often shifts northward, when favourable tacks may be made to the eastward.

Chart 1078, Tracks followed by vessels with sail and low steam power.

For the Húgli do not then approach either shore, but work to windward in the middle of the bay, where there is smooth water and moderate wind; from close westward of the Nicobar islands the entrance of the Húgli has often been reached without tacking. If the equator is crossed late in February or in March, keep well to the westward in standing up the bay.

If bound to Trincomalí or Madras do not go eastward of long. 90° E.

Bay of Bengal.—There is no difficulty in proceeding from southern to northern ports in the Bay of Bengal during the South-west monsoon, nor from northern to southern ports during the North-east monsoon. Vessels bound from a port on the eastern side to a port on the western easily make the passage during the North-east monsoon; so also do vessels from a western to an eastern port during the South-west monsoon.

When the monsoon is contrary, a sailing vessel must work up or down, as the case may be; or after standing some distance across the bay then shape course direct. At the change of the monsoon, voyages are usually tedious, for the light and variable winds then prevalent, being as often adverse as favourable, every slant should be taken advantage of, and the north-eastern part of the bay avoided, unless bound to, or from, one of the ports on that side of the bay.

In working down the Bay of Bengal in the South-west monsoon, sailing vessels should keep well westward of the Andaman islands, that they may not be on a lee shore should a strong westerly gale set in; or, which is better, pass through Preparis north or south channel, and then work southward in the comparatively smooth water eastward (or to leeward) of the Andaman and Nicobar islands.

Fast sailing vessels from Calcutta, in the South-west monsoon, do beat down the Bay of Bengal, reaching about 100 miles westward of the Andaman islands; but the wear and tear is great, and the saving in time slight.

Low-powered steam vessels take nearly the route of sailing vessels, except where given in the tabulated form. Such vessels at times take the route for full-powered steam vessels, but they must always be guided by their steaming capacity.

CHAPTER II.

WEST, SOUTH, AND EAST COASTS OF CEYLON; FROM COLOMBO TO PEDRO POINT.

(*Lat. 5° 55′ N. to lat. 9° 51′ N.*)
(*Long. 79° 40′ E. to long. 81° 53′ E.*)
VARIATION WESTERLY: Slightly increasing.

Chart 3700, 813, Colombo to Galle, and Ceylon, South coast. Var. 1° 10′ W.

CEYLON.—West coast.—Aspect.—The west coast of Ceylon is low near the sea, and almost entirely planted with cocoanut trees. Inland the foothills of the mountain district begin, abreast of Colombo, at about 20 miles from the shore, their western boundary running southward and nearly parallel to it, but gradually approaching the sea near Dondra head, the southernmost point of the island.

Adam's peak (*Lat. 6° 49′ N., Long. 80° 30′ E.*), the highest land visible from off the west coast, rises to a height of 7,353 feet, and is 36 miles from the sea; it is generally veiled in haze during the South-west monsoon, though an excellent landmark for the remainder of the year.

The culminating peak of Ceylon is Pedrotalagala, about 20 miles north-eastward of Adam's peak, which reaches a height of 8,326 feet. South-westward of Adam's peak there is much elevated country.

Of the higher western foothills, only two are likely to be distinguished from seaward, the first, named Hiniduma Kanda, or "Hill of Vapours" (The Haycock), 2,160 feet, and nearly 20 miles northward of Point de Galle, appears from all points as a large round-topped hill, occupying a prominent position in the foreground of the hills, and is conspicuous from seaward, having the same appearance from all points of view; from a position a little eastward of Point de Galle, and round to the northward, as far as the vicinity of Barberyn lighthouse it forms a valuable landmark.

Mórowak Kanda, 2,373 feet high, about 13 miles E. by S. from the Haycock, has three remarkable summits, lying in a north and south direction, with a very abrupt fall, and is, from the same points of view, as conspicuous as the Haycock, and often when one is covered the other is visible.

General charts 828, 70.

Chart 813, Ceylon, South coast.

Depths off-shore.—Off the west coast of Ceylon the 100-fathoms contour line is found at about 15 miles southward of Adam's bridge, on the parallel of 9° N., trending in a south-east direction to that of 8° 30′ N.; it then has a nearly south direction to the parallel of 7° N., and is 13 miles off the coast abreast of Colombo.

From this it follows the trend of the coast, and is 15 miles off the coast abreast of Barberyn lighthouse, from which it gradually approaches the land to within about 10 miles, which distance it preserves, more or less, round the south coast of the island.

The bank of soundings on the whole coasts of the island, where sufficiently investigated, has been found to have a remarkably steep edge, strongly marked, and forming a valuable guide when making the land in thick weather or at night.

The 20-fathoms contour line is from 3 to 5 miles off-shore between Colombo and Barberyn lighthouse, but northward of Colombo it trends outwards to the north-westward, forming a bank, possibly formed partly of detritus from the Kelani Ganga, carried northward by the prevailing current during the South-west monsoon.

Plans 914, Colombo harbour; and 3686, Approaches. Var. 1° 10′ W.

Current.—The current off the west coast of Ceylon is variable about the change of monsoon, and appears generally to set in different directions when to the southward or northward of Colombo, being southerly in the first, and northerly in the second, instance; but its rate never exceeds above one knot, being strongest in August and December.

After careful comparison, it appears that any changes in direction or velocity are not connected in any way with the tidal rise and fall by the shore, nor with the phases of the moon.

APPROACHES TO COLOMBO.—Aspect.—The land in the vicinity of Colombo is low, and will therefore not be seen from any great distance, but, in exceptionally clear weather, the Ceylon mountains and Adam's peak may be visible from a great distance, but the clock tower lighthouse is usually first seen when about 12 miles distant.

On closing the land, a dark clump of trees behind the lighthouse, the trees on Mutwal point, and the spire of All Saints church (nearly in line with the lighthouse) will next appear, and shortly after the dark banyan tree and Mount Lavinia hotel, to the southward, will be made out. Mount Lavinia hotel, painted white, and elevated 96 feet above high water, has, on a clear afternoon, been seen from a distance of 12 miles.

LIGHT (*Lat. 6° 56′ N., Long. 79° 51′ E.*).—The clock tower, a square building, 112 feet in height and painted white, is situated in

General charts 828, 70.

that part of the town known as the Fort, and from it is exhibited, at an elevation of 135 feet above high water, a *white group flashing* light, with a period of system of *ten seconds*, showing, from the southward and westward, thus:—flash, *three-tenths of a second;* eclipse, *one and four-tenths seconds;* flash, *three-tenths of a second;* eclipse, *one and four-tenths seconds;* flash, *three-tenths of a second;* eclipse, *about six and three-tenths seconds;* it should be visible in clear weather from a distance of 17 miles, but between the bearings of S. 8° W. and S. 43° W. the flashes are irregular in number, showing sometimes as one flash or two flashes.

DANGERS IN APPROACH.—Galua or Drunken Sailor rock (*Lat. 6° 56′ N., Long. 79° 50′ E.*) consists of two rocks close to each other, the outer of which has a depth of 4 feet and the inner of 10 feet; from the outer rock the clock tower bears E. by N. ⅝ N., distant 5$\frac{2}{10}$ cables. The shoal on which these rocks stand is 1½ cables long in an east and opposite direction, three-quarters of a cable wide, and surrounded by depths of from 6 to 8 fathoms.

Buoy.—A spherical buoy, painted black, is moored in 8½ fathoms water at three-quarters of a cable westward of the shoalest head, but is withdrawn during the South-west monsoon, as the rock then breaks heavily and constantly.

Pala Gala or Tartar rock, a rocky head having a depth of 19 feet over it, and from 6 to 8 fathoms all round, lies 6$\frac{3}{10}$ cables north-west of the clock tower, and, owing to its small size, never breaks.

Buoy.—A spherical buoy, painted red, is moored in a depth of 8 fathoms, three-quarters of a cable north-westward of the rock.

Kelani Gala, a narrow bank on which the depths are from 9 to 10 fathoms, is about 1¼ miles in length, and lies about 2¼ miles westward of the entrance to the harbour.

Ona Gala ridge, rocky and with a least depth of 3½ fathoms over its northern end, is situated 2$\frac{9}{10}$ miles N. by W. ⅛ W. from the lighthouse on the head of the South-west breakwater. A shoal which extends one mile in a southerly direction from the above head is about 50 feet broad, and has four other heads with depths of from 4 to 4½ fathoms over and with from 5 to 7 fathoms between them.

To the eastward and westward of the ridge there are depths of from 7 to 8 fathoms, and the lead gives little warning of the approach to it.

LIGHT BUOY.—A buoy, painted red, exhibiting a *white occulting* light *every four seconds*, showing light, *two seconds;* eclipse, *two seconds*, is moored in 6¾ fathoms water, N. by W. ¼ W., distant 2 miles from the lighthouse on the South-west breakwater head, and half a mile southward of the southernmost shoal head.

General charts 3700, 813, 68b, 828, 70.

Plan 914, Colombo harbour. Var. 1° 10′ W.

Pilots.—Pilotage is compulsory for all merchant vessels above 200 tons. Steam vessels should make the usual day signal, and burn a *blue* light at night, but sailing vessels, not being taken into the harbour at night, need only use the former. Vessels can also communicate by the semaphore with the pilot station by day, and by flashing Morse signals by night. The pilot boats, towed by a steam launch, display the Trinity House pilot flag by day and exhibit a flare at intervals by night, and will board vessels about one mile outside the harbour. *See* Pilotage rates, page 101.

Directions.—Approaching from the westward, steer for the lighthouse, bearing about East, until the position is ascertained, when a course clear of danger may be shaped for the harbour. Coming from the northward or from the southward, keep outside the 20-fathoms contour line until the lighthouse bears East, when proceed as above.

OUTER ROADSTEAD (*Lat. 6° 56′ N., Long. 79° 50′ E.*).—Vessels calling for orders, those in quarantine, or not intending to enter the harbour, can anchor, even in the South-west monsoon, in 8 or 9 fathoms water, in the Outer roadstead, westward of the South-west breakwater, with the lighthouse on the South-west breakwater bearing E. ⅞ S., and the clock tower S.S.E. ½ E.

Signals.—Vessels desiring to communicate with the port signal station, by means of the undermentioned codes, should use the following preparatory signals:—

Code.	Preparatory signal.
International - -	Code or answering pennant hoisted in some conspicuous place.
Semaphore or Morse	Pennant F hoisted under code pennant.
Night - - -	Continuous short and long flashes with lamp until letter T is made from the signal station.

Night pilot signals.—The following signals are shown at night from the pilot's lookout tower, near the flagstaff, in answer to signals for a pilot made by vessels approaching the harbour:—

An electric light, showing *red* and *white* flashes alternately in *quick succession* for a period of *one minute*, indicates that a pilot will proceed immediately to the vessel making the signal.

A *red fixed* light for the same period indicates: Pilot engaged; will proceed to the vessel making signal when disengaged. When this signal has been made, vessels arriving off the port at night must not approach within half a mile of the *red* light on the South-west breakwater head, until the pilot boat is seen, showing a flare-up, approaching them.

General charts 3700, 813, 68b, 828, 70.

Plan 914, Colombo harbour. Var. 1° 10′ W.

A *white flashing* light of about *two minutes'* duration indicates: Vessel should anchor well out, or keep under way until daylight.

Outward-bound vessels requiring a pilot should hoist the Jack at the fore during the day, and two *red fixed* lights, vertical, 6 feet apart, by night.

Tugs.—There are two powerful Government tugs, the signal by day for them being Y P of the International code, and by night one long and four short blasts with a steam whistle.

COLOMBO HARBOUR, entirely artificial, is formed by three breakwaters. The South-west breakwater, 4,210 feet in length, extends in a northerly direction from the south point of the harbour; and from Mutwal point, on the north side, the North-east breakwater extends 1,100 feet in a westerly direction. Between these is the North-west breakwater, detached, and 2,670 feet in length in a north-east and opposite direction, with openings at each end of it, that to the northward being 700 feet and that at its south-west end 800 feet. The area enclosed by these breakwaters is 660 acres.

An arm, from 1,800 to 2,000 feet in length, is in course of construction in a northerly direction from near the extreme of the South-west breakwater; it will completely shelter the western entrance between the South-west and North-west breakwaters.

The eastern side of the harbour is entirely artificial, and about 3 cables from its northern end is the entrance to the graving dock, with a guide pier on its northern side; the pumping house chimney, on this side of the dock, is 100 feet high, built of red brick, and conspicuous.

Southward of the dock entrance is the coaling depôt belonging to the various coal companies, with 18 wooden jetties for coal lighters to load or discharge coal; the general depth alongside them is about 15 feet. The coaling depôts and jetties continue along the southern end of the harbour as far as the Passenger jetty, which is a double-decked pier, roofed, and about 200ft. long, with 6 feet water alongside; it is the official town landing place, under the Customs authorities.

Depths.—There is a depth of 39 feet in the western entrance, and 36 feet in that from the northward, and the harbour, which has been kept as nearly as possible to a minimum depth of 30 feet, is being increased by dredging to 33 feet. The harbour is capable of berthing about 40 vessels of from 20 to 30 feet draught in the North-east, and 44 in the South-west, monsoon.

LIGHTS (*Lat. 6° 57′ N., Long. 79° 51′ E.*).—**South-west breakwater.**—A red fixed light is exhibited, at an elevation of 56 feet above high water, from a lighthouse, 58 feet in height, situated on the north extreme of the South-west breakwater; it should be visible, in clear weather, from a distance of 12 miles.

North-west breakwater.—From a cylindrical tower, 40 feet in height and painted stone colour, on the south head of the North-west breakwater, a *green fixed* light is exhibited at an elevation of 42 feet above high water.

From a similar shaped and coloured tower, 37 feet in height, and situated on the north head of the North-west breakwater, a *red fixed* light is exhibited at an elevation of 42 feet above high water. Both the above lights should be visible, in clear weather, from a distance of 10 miles.

North-east breakwater.—From a lighthouse, 33 feet in height, on the head of the North-east breakwater, a *green* and *red fixed* light is exhibited at an elevation of 44 feet above high water, which, in clear weather, should be visible from a distance of 5 miles; it shows *green* seaward and *red* landward, each sector being 180°.

Electric search lights are sometimes exhibited from the end of the North-east breakwater.

Leading lights (*Lat. 6° 57′ N., Long. 79° 51′ E.*).—Two pairs of leading lights are shown in the harbour as a guide to the northern entrance, and to facilitate passage between the mooring buoys.

The first pair are shown from masts, the front, at the coal depôt, being *green fixed*, at an elevation of 42 feet above high water; the rear light is *red fixed*, at an elevation of 50 feet above high water, and when in line, bearing S. 10° W., they lead between the second and third lines of mooring buoys. They should be visible, in clear weather, from a distance of 3 miles, but not westward of the line of the breakwater.

The second pair are shown from masts 48 and 47 feet in height, respectively, and painted white; the front, situated near the patent slip, is *red fixed*, at an elevation of 50 feet, and the rear *green fixed*, and near the cemetery, at an elevation of 60 feet above high water.

These lights when in line, bearing S. 10° W., lead through the north entrance midway between the North-east and North-west breakwaters, and between the fourth and fifth lines of mooring buoys; they should be visible, in clear weather, from a distance of 3 miles.

Two *green fixed* lights, placed vertically, are shown from the Passenger jetty, and two *green fixed* lights, placed vertically, from the Guide jetty.

LIGHT BUOY.—A buoy, painted brown, and exhibiting a *red occulting* light, with a period of system of *ten seconds*, showing light, *five seconds; eclipse, five seconds*, is moored at the extremity of the breakwater in progress. Vessels must not pass to the southward of this buoy, which will be withdrawn on the completion of the breakwater.*

Mooring buoys.—Four lines of mooring buoys are placed in the northern, and six lines of mooring buoys in the southern, part of the harbour, the lines being in a north and south direction, and 2 cables apart. The buoys are numbered from 1 in the southern part to 53 in the northern part.

Vessels-of-war are usually berthed in the northern part of the harbour, except when likely to remain for some time, when they are given berths in the southern portion.

All vessels are berthed by pilots, and moored head and stern, as well as by letting go an anchor, the heads being to the northward during the North-east monsoon, when the spaces between each line of buoys serve as channels up and down the harbour.

During the South-west monsoon the heads are to the westward, when the spaces between the second and third, and the fourth and fifth, lines of buoys, from the breakwater, are reserved as the channels, for which the leading lights already mentioned are guides.

In three berths close to the North-west breakwater vessels are moored with head to the north-west during the North-east monsoon. There is a clear channel between these buoys and those to the southward of the North-east breakwater, and also one for entering the dock.

During the South-west monsoon vessels mooring inside the North-west breakwater invariably use both anchors, in addition to securing to a buoy.

Vessels are not to change their berths without the sanction of the Master Attendant, whose office is at the south end of the harbour, and they must attend to their own hawsers.

Vessels should endeavour to arrive during daylight in the strength of the monsoon, as at that time pilots will not berth them by night.

Foul weather signal.—Should additional precautions be considered necessary for the safety of shipping, a red ball will be hoisted by day and a *red* light exhibited by night at the pilots' flagstaff, and on this signal being made vessels must run out extra hawsers to the buoys.

Harbour police.—The signal for the harbour police is the ensign at the main by day and by night two *white* lights with a *red* light between them, *placed vertically*.

Port limits (*Lat. 6° 57′ N., Long. 79° 51′ E.*).—The southern limit is a line 3 miles in length, drawn due west from a point on the beach one mile south of the flagstaff; the northern limit, a similar line in direction and length, from a point on the beach one mile north of Mutwal point; the western limit is the line joining the western ends of these lines, and the eastern limit the shore between the south and north limits.

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* A *green occulting* light, showing light, *seven seconds*; eclipse, *three seconds*; and exhibited from a lattice mast near the slipway, when in line with the *red fixed* light on the South-west breakwater head, bearing S. 16° E., shows over the extreme northern end of the foundations of the breakwater extension.

Ballast, ashes, &c.—No ballast, ashes, or rubbish is allowed to be thrown overboard from any vessel or boat within the port, or in a less depth than 12 fathoms.

Quarantine.—The quarantine signal is to be hoisted by all vessels arriving in the harbour, and no person, except the pilot, is allowed on board, or to leave the vessel, until pratique has been given.

Vessels having, or having had ten days previous to arrival, any infectious disease are placed in quarantine for a period decided by the Chairman of the Plague Committee. In such a case the vessel may have to anchor in the outer roadstead, or other place, as directed by the Master Attendant.

Vessels in quarantine must display the quarantine flag by day, and two *white fixed* lights, placed vertically at the fore, by night.

Vessels having cholera, yellow fever, or plague when within the 3-mile limit of the coasts of Ceylon must make the following signals:—

(*a*) By day, a flag of the International Code quartered black and yellow.

(*b*) By night, three lights placed triangularly 6 feet apart and 20 feet above the hull, the colour of the light at the apex being *white*, and the other two *red*.

Pilotage rates.—The Government pilotage charges, which include berthing, are Rs. 15 for vessels up to 499 tons gross, increasing progressively by Rs. 5 for every 500 tons upward. The charges for a vessel of 5,000 tons gross would therefore be Rs. 65.

Directions.—Until the completion of the breakwater extension the western entrance should not be used, and on account of merchant vessels being berthed in the southern part of the harbour it has mostly been used by them. Vessels using it should not pass to the southward of the buoy marking the extremity of the breakwater in course of construction. Care is also necessary when the electric searchlights are being worked on the North-east breakwater end, as being liable to cause confusion.

The northern entrance is chiefly used by vessels-of-war, and when entering by it, from a position 3 cables to the northward of the northern light of the North-west breakwater, steer to pass through its centre, with the masts from which the *red* and *green* lights are exhibited in line bearing S. 10° W., but they are not easily seen. When in the centre of the northern entrance a conspicuous, tall, iron chimney should be ahead.

Plan 914, Colombo harbour. Var. 1° 10′ W.

Tides.—It is high water, full and change, at Colombo at 1h. 50m.; springs rise about 2 feet, and neaps only a few inches; the tides are affected by diurnal inequality in both high and low water heights. In the South-west monsoon, when the mean level of the sea is lowest, the difference between high and low water is from 5 to 15 inches. When the tidal rise does not exceed 6 inches the rise and fall sometimes occurs four times in twenty-five hours.*

COLOMBO (*Lat. 6° 56′ N., Long. 79° 51′ E.*), the capital of Ceylon, named after Columbus by the Portuguese, consists of the European town or the Fort, and the native town or pettah. The fort, originally constructed by the Portuguese and Dutch, is now laid out, in European fashion, with streets shaded by trees and handsome commercial buildings. The Governor's residence (Queen's house), post office, and Government offices are amongst the buildings, and the clock tower stands on its highest part, the military barracks being in the southern quarter.

The native town, or pettah, separated from and situated eastward of the fort, has streets consisting of narrow lines of shops. The Kachchere (Government agent's office), the town hall, and the municipal offices are here; and in the district known as Hulftsdorp are the law courts and All Saints church, the spire of which is a conspicuous landmark.

Mutwal suburb stretches from the northern part of the native town almost to the south bank of the Kelani Ganga, and contains the Cathedral church, with a square-topped stone tower, and the Roman Catholic cathedral, which having a white dome, surmounted by a cross, is conspicuous from the harbour. To the southward of the fort is Galle Face, a fine esplanade, and Slave island, the military head-quarters. The town is lit by electricity.

Population.—The population, in 1901, was 158,228, of which 2,039 were Europeans, 11,851 Eurasians and Burghers, and the remainder Sinhalese and other Eastern races.

Communication.—The steamship, railway, and telegraphic communications are given in Chapter I., page 4. A double line of railway connects the harbour with the terminus station. Electric tramways run in a north-east and south-east direction from the fort for about 3½ miles in each direction.

Coal and supplies.—About 70,000 tons of coal, and 3,000 tons of liquid fuel are kept in stock; all vessels are coaled by bags, from lighters, at an ordinary rate of from 80 to 100 tons an hour.

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* Full predictions of the tides at Colombo are given in Tide Tables for the Indian Ports, Part II., published annually.

Plan 914, Colombo harbour. Var. 1° 10′ W.

About 755,000 tons of coal and 8,000 tons of oil fuel are imported annually.

Fresh meat, vegetables, and bread can be procured in any quantity and at moderate prices. Tanks bring fresh water alongside, and vessels requiring one should hoist the flags Y R of the International code.

Dock.—*See* Appendix, page 565.

Repairs.—Two engineering firms can undertake repairs to engines or boilers, and iron castings up to 10 tons in weight can be made; amongst the several Government cranes is one capable of lifting 15 tons. European or native divers are obtainable, and there are appliances for salvage and extinction of fire.

Hospital (*Lat. 6° 56′ N., Long. 79° 51′ E.*). — Seamen are admitted to the general hospital at Maradana, situated 1½ miles southward of the harbour.

Sailors' home.—A sailors' home is maintained.

Landing troops.—In the event of foreign vessels of war or transports intending to land troops, if more than 250 men are required to be landed, a form giving the name and nationality of the vessel, with the number of men it is intended to disembark, is to be filled in and given to the pilot.

Time signal.—A time signal is made daily, except on Sundays and public holidays, at a flagstaff adjoining the Master Attendant's office. The signal is a red and white semaphore, inclined at an angle of about 45°, as preparatory, at five minutes before signal, placed horizontally at two minutes before, and dropped at 4h. 15m. 0s. p.m. Indian standard time, equivalent to 22h. 45m. 0s. Greenwich mean time.

The semaphore is also dropped at 8h. 15m. 0s. a.m., Indian standard time, equivalent to 14h. 45m. 0s. Greenwich mean time, with the exception of the days above mentioned.

Position (*Lat. 6° 55′ 55″ N., Long. 79° 50′ 34″ E.*).—The position given is that of the clock tower, depending on Madras Observatory being in long. 80° 14′ 51″ E.

Trade.—Nearly the whole trade of Ceylon passes through Colombo. The chief exports are tea, coffee, chinchona, cocoa, cocoanut products, cinnamon, citronella oil, and plumbago; the imports rice, cotton goods, metals and metal ware, coal and coke. In 1908 the total trade amounted in value to £17,365,000, the exports to the United Kingdom being £4,260,000 and imports £2,284,000; in the same year 684,179 tons of coal were imported.

Plan 914, Colombo harbour. Var. 1° 10′ W.

Winds.—Page 62.

Climate.—Page 5, and Meteorological table, page 571.

Chart 3686, Approaches to Colombo.

COAST.—From Galbokka point, a black, rocky knoll, 14 feet high, connected to the shore on the western side of the Fort by a short sandy isthmus, the coast having a southerly direction, is a sandy beach, with trees and cocoanut palms springing nearly from the water's edge.

Several detached rocks lie close off Galbokka point, and on a small eminence just above it is the pilot station, a circular building with two storeys of arches and a flat top; it is painted white, is very conspicuous against the dark trees of the Queen's house gardens behind it, and is fronted by a tall white signal mast for signalling purposes.

Other conspicuous objects immediately to the southward, where the fort ends, are the Galle Face esplanade, three-quarters of a mile in length; the Echelon military barracks; the Artillery officers' mess, a square, flat-topped building, painted white; and the Galle Face hotel, a large red building; while at night the position is readily known by the row of brilliant white lights along the sea shore.

Farther south are the bungalows of the various suburbs, stretching along the Kollupitiya road, and the louvred exteriors of the railway stations of the Coast line, which are painted stone colour, and show up prominently in the afternoon light, on the very edge of the beach.

Communication.—On this stretch of coast are stations of the Coast railway at Kollupitiya, Bambalapitiya, Wellawatta, Dehiwala, and at Mount Lavinia.

Mount Lavinia (*Lat. 6° 50′ N., Long. 79° 52′ E.*), about 6 miles southward of Galbokka point, may be recognised by the hotel, a large building, painted white, standing on a small rocky eminence on the edge of the sea, its roof being about 80 feet above it. The land slopes upward behind it for a short distance, forming a dark background, and it is the most conspicuous object on this part of the coast, being visible in a clear afternoon from a distance of about 12 miles.

At about three-quarters of a mile northward of the mount, and 2 cables from the beach, is a large banyan tree, which is usually also very conspicuous, its rounded top standing well above the straight, even line of the cocoanut palm tops.

Reef.—Between Colombo and Mount Lavinia a narrow ridge of gneiss rock, having the appearance of a barrier reef, and awash in some places, lies parallel to the beach at from half to three-quarters of a cable distant; at about three-quarters of a mile northward of Mount Lavinia there is a break in the reef through which small coasting

Chart 3686, Approaches to Colombo. Var. 1° 10′ W.

vessels, trading with coral for lime-burning purposes, enter, and anchor under its protection.

The average depth just outside this ridge is 4 fathoms, with from one fathom to 2 fathoms between it and the shore.

Chart 3700, Colombo to Galle.

Dangers.—A narrow rocky bank, 2 miles in length, with less than one fathom water over it, lies half a mile from, and parallel to, the coast southward of Mount Lavinia.

At 3½ miles southward of Mount Lavinia, abreast Moratuwa railway station, and half a mile off-shore, is a rocky bank with 2¾ fathoms water on it; the bank on which this stands stretches about 1¼ miles to the southward, and has depths of 3¼ and 3½ fathoms on it.

COAST.—From Mount Lavinia for a distance of 20 miles to the southward the appearance of the land is very similar to that northward of Colombo, being formed by a narrow sandy beach with dense groves of cocoanut palms immediately behind it, whose tops rise to a uniform height of about 85 feet; the land behind, stretching back for from 10 to 20 miles, is densely wooded, with numerous towns and villages.

Nawagam Kanda (*Lat. 6° 55′ N., Long. 80° 0′ E.*) and Oleboda Kanda, two small, flat-topped, wooded hills, lie about 8 miles inland, but are not easily recognised; they are 432 and 371 feet high respectively.

From a distance of about 4 miles off-shore in this locality there are really no conspicuous objects, but in clear weather, with a favourable light, a single tall casuarina tree, standing above the level of the cocoanut trees, and situated 2 miles southward of Mount Lavinia, might be distinguished.

The coast railway from Colombo to Galle and Matara runs practically along the sea front for the whole distance, and by the side of the coach road, the entrances to rivers, creeks, &c., being crossed on iron girder bridges which are generally visible from seaward. Government rest-houses are established on the coast, and are usually situated near railway stations.

Moratuwa, a town with 29,600 inhabitants, is about 3½ miles from Mount Lavinia, and its church (Immanuel), which has a square red tower, may sometimes be seen.

Communication.—Moratuwa has a railway station on the Coast railway, also post and telegraph offices.

Pánadure, a town on the coast about 7½ miles southward of Mount Lavinia, has a population of 3,845, but, owing to the surf, it has no seaward trade.

Chart 3700, Colombo to Galle. Var. 1° 10′ W.

Pánadure Ganga, a long, irregular, fresh-water lagoon, is situated about 2 miles from the coast, and extends roughly parallel to it, discharging, when full from the rains, at the town, but it is usually barred by sand. It is connected to the northward with Colombo, and to the southward with Kálu Ganga, by a system of canals.

Communication.—There is railway communication with Colombo, and a post and telegraph office.

Gonagala, the outer of two rocks on the southern side of the entrance to Pánadure Ganga, is round-topped, and 15 feet above high water; it lies nearly one mile west-south-westward from the town, and has a depth of 3¼ fathoms close outside it.

Alut Gala, on which the depth is 3¼ fathoms, is situated half a mile south-westward of Gonagala.

Nilkete rock consists of two heads with a depth of 2 fathoms over them, and is situated about 1½ miles from the land, and 2 miles south-westward of Pánadure; it is surrounded by depths of 7 and 8 fathoms.

Po Gala, with a depth of 2¾ fathoms over it, lies about 3 cables to the southward of Nilkete rock, with a depth of 7 fathoms between, and there is a patch, with 4¼ fathoms over it, about three-quarters of a mile south-eastward of Gonagala. Inside these are other patches, abreast the conspicuous banyan tree, the positions of which are best seen from the chart.

Anchorage.—There is anchorage westward of Gonagala, in depths of from 10 to 12 fathoms, at 2 miles off-shore; in approaching it, Nilkete and other rocks to the southward must be avoided.

COAST.—From Pánadure the coast, with a slight bend, has a south-south-east direction for about 8 miles to Kálutara, at the entrance of Kálu Ganga, and is a featureless sandy beach, on which the surf breaks continually. One mile southward of Pánadure there is a solitary round-topped banyan tree, which may be seen from a distance of about 10 miles.

Kaluwatte Gala, lying on the edge of the 10-fathoms contour line 2¾ miles off-shore, and 3½ miles southward of Gonagala, has 5 fathoms water over it, and is surrounded by depths of from 9 to 11 fathoms.

Uan Gala, also on the edge of the 10-fathoms contour line, has a depth of 3 fathoms over it, and lies 6 cables south-eastward of Kaluwatte Gala, and 2½ miles from the coast; it is surrounded by depths of 9 to 10 fathoms.

Kálutara (*Lat. 6° 35′ N., Long. 79° 58′ E.*), an important town with 11,500 inhabitants, is situated on both banks of the Kálu Ganga, the mouth of which is impassable for anything but native canoes, on account of the surf; the river is about 62 miles in length, from its source in the southern part of the mountain district. An Assistant Government Agent resides in the town.

Communication.—The town has railway communication with Colombo, and there is a post and telegraph office.

Uheliya reef is the outer and most extensive of an area of patches and uneven ground lying off the mouth of the Kálu Ganga, and is narrow, about one mile in length, and parallel to the shore; it has depths of from 4 to 5 fathoms, surrounded by 6 to 7 fathoms, and is 2$\frac{4}{10}$ miles westward of Kálu Ganga mouth.

Pittaniya, Pallaipara, and Módara Muduwa rocks, with 3 fathoms, 1½ fathoms, and one fathom to 1½ fathoms respectively, form a chain about one mile in length in a north and south direction, the northern rock being off the mouth of the Kálu Ganga; they are surrounded by depths of from 4 to 6 fathoms.

Anchorage.—The anchorage is in from 5 to 6 fathoms water, about one mile from the entrance of the river.

Directions.—In approaching Kálutara keep about 5 miles offshore until the fort bears N. 76° E., or is in line with Adam's peak, if it is visible, which bearing or mark leads between Uheliya reef and Pittaniya rock.

Coast.—The coast, still having a south-south-east direction, trends in a perfectly straight line of sandy beach for a distance of about 4½ miles to Maggona point, a small rocky headland, about 30 feet high, forming the first break in the character of the sandy shore from Mount Lavinia.

Communication.—Maggona village is eastward of the point, and is a station on the Coast railway.

Landing may be effected here on a fine day, but it is neither good nor safe.

Tria Gala (*Lat. 6° 30′ N., Long. 79° 58′ E.*), a rock 5 feet high, steep-to, and surrounded by depths of 4 and 5 fathoms, lies 1$\frac{1}{10}$ miles west-north-west of Maggona point.

The outermost danger, lying 1$\frac{6}{10}$ miles north-north-west of Tria Gala, has a depth of 3½ fathoms over it, and is surrounded by 6 and 8 fathoms.

A 3-fathoms patch lies 1$\frac{2}{10}$ miles northward, and a rock, always breaking and easily seen, 3 cables southward, of Tria Gala.

Prompt rock and Madda Gala (Fanny rock) are important dangers on account of lying not far within the 20-fathoms contour line, and as the westernmost dangers off this part of the coast, from which the outer is distant 3½ miles; they are small; the depths might be less in the swell of the South-west monsoon, and the lead gives no warning of approach to them.

Prompt rock has a depth of 4½ fathoms over it, and lies 3 miles west-north-west of Barberyn lighthouse; it has from 13 to 17 fathoms round it.

Madda Gala has 3¼ fathoms water over it, and is surrounded by depths of from 12 to 14 fathoms; it is 2$\frac{4}{10}$ miles in nearly the same direction from Barberyn lighthouse as Prompt rock.

Beruwala is a small bay and village, the former formed by a slight curve in the sandy beach about 2 miles from Maggona; the village is about three-quarters of a mile from the Customs landing place.

Communication.—Beruwala is a station on the Coast line.

Landing.—On the western side of Beruwala bay, formed by a small rocky promontory, landing may be effected even in the South-west monsoon, but, the approach being shallow from the shelving nature of the beach, it is generally necessary to wade: here is a Custom-house, and it is the only safe place on the coast from Colombo for boat landing.

WELMADUWA ISLAND (*Lat. 6° 28′ N., Long. 79° 58′ E.*), which fronts the coast south-westward of the small promontory referred to, is about a quarter of a mile from the shore, and wedge-shaped, the highest part, which is seaward, being 47 feet high.

The island, circular in shape, is about 1½ cables in diameter, covered with cocoanuts, and with a rocky cliff seaward.

LIGHT.—Barberyn lighthouse, on the summit of the island, is a cylindrical tower 111 feet in height and painted white, which exhibits, at an elevation of 150 feet above high water, a *white flashing* light, with a period of system of *one minute*, the duration of the flash being *five seconds;* in clear weather it should be visible from a distance of 18 miles.

Landing.—Two small piers on the eastern side of the island afford landing, which is generally possible there and on the beach of the mainland abreast.

Aspect.—Between Kálutara and Beruwala some low hills are situated behind the coast, the northernmost that is at all conspicuous from seaward being Bombuwela, a small range 2 miles long in a north-north-east and south-south-west direction, having near its southern end a conspicuous flat-topped hill, 522 feet high. *View B on 3700.*

Weragal Kanda (Beach hill), isolated, wooded, except at the summit, and very conspicuous, is 351 feet high, conical shaped, and has a white dagoba or monument on its bare summit.

Chart 3700, Colombo to Galle. Var. 1° 10′ W.

Various other hills, about 500 feet in height, are situated about 5 miles inland from Barberyn lighthouse, but none are easily distinguished.

Depths off-shore.—The 10-fathoms contour line lies three-quarters of a mile from the shore at Mount Lavinia, and recedes from the coast to a distance of 3 miles between Pánadure and Welmaduwa island.

Within this depth are situated several dangers, and vessels navigating in this vicinity, or making Colombo from the southward, should not approach the land within the depth of 20 fathoms until Mount Lavinia hotel bears southward of East.

Off Welmaduwa island foul ground extends fully 3 miles from the shore, the outer danger being Prompt rock; under ordinary circumstances the island should not be approached within a distance of 4 miles. *See* page 107.

Anchorage.—During the fine weather period of the North-east monsoon it is possible to anchor almost anywhere off this coast, outside and clear of the broken and foul ground: the holding ground is good, over a bottom of soft green mud. It is not advisable to anchor off Beruwala in less depths than 6 or 7 fathoms owing to the dangers already described, and the swell which is generally experienced.

COAST.—From abreast Welmaduwa island the coast, trending in a south-south-east direction for about 3 miles to the mouth of the Bentota Ganga, is somewhat indented, sandy, with small rocky projections, and has a few off-lying rocks. Half a mile northward of the entrance is a conspicuous white house near the beach, and Bentota Rest house is also fairly conspicuous, standing amongst trees on the southern point of the river.

Bentota Ganga is a small stream, with a shallow and rocky bar, which usually breaks; it can only be entered by canoes, but they can ascend for a distance of 12 miles.

The three most prominent rocks which lie off Bentota are:—Paraiduwa, the northern, 15 feet, and Palli Gala, 6 cables southward of it, 20 feet high; Handran Gala, the largest, and 8 feet high, lies 7 cables west-south-west from the Rest house, and is surmounted by a boulder. All these rocks are black, and bare of vegetation.

Udapitya point (*Lat. 6° 26′ N., Long. 80° 0′ E.*) is the southern entrance point of Bentota Gala, and between it and Handran Gala are several small rocks, with foul ground generally, rendering the passage unsafe for anything but native canoes.

General charts 813, 828, 70.

Chart 3700, Colombo to Galle. Var. 1° 10′ W.

The three following rocks lie in a line parallel to the coast, and at the distance of half a mile off it:—

Deba Gala, a boulder with a depth of 9 feet over it, and from 3 to 4 fathoms round.

Maharatara, a group of large boulders with three heads, on which the depths are 3 feet, and from 4 to 5 fathoms surrounding it.

Nabutara, a rocky ledge, the shoalest part of which is awash at low water, with from 4 to 5 fathoms round; it lies 7 cables southward of Handran Gala.

Communication.—Bentota is a railway station on the Coast line, the station, named Alutgama, being on the north bank of the river.

COAST.—From Bentota Ganga the coast, trending in a south-south-east direction for about 7 miles, is formed by a brown sandy beach, divided by several small rocky headlands, and is thickly planted with cocoanut trees to the water's edge.

Godagala, Yakgahagala, and Kayikawalagala are three of the small headlands mentioned above, occurring in order from the northward in the first half of the distance. The first, dark coloured and 30 feet high, is not very conspicuous; the second, a bare sloping rock 35 feet high, is plainly visible from a distance of 3 to 4 miles; and the third is low and not remarkable.

Galboda Kanda (*Lat. 6° 23′ N., Long. 80° 1′ E.*), a flat-topped hill 154 feet high, is situated between the last two points and half a mile inland; on its summit is a temple and a white monument, and it is conspicuous from seaward, being visible in clear weather from a distance of 10 miles.

About 1¾ miles south-eastward from Kayikawalagala point is a large square-topped tree, above the others, which in clear weather may be seen from a distance of 14 miles.

In the latter part of this stretch of coast are **Babungala and Arangala** points, the first reddish and 25 feet high, and the last rocky and 40 feet high; neither is conspicuous.

A small hill, 110 feet high, lying half a mile east-north-east of Arangala, is crowned by a temple and monument, but being surrounded by trees it is not seen from all points.

Dangers.—Dodampara rocks, two small rocks 3 feet above water, lie 3 cables westward of Kayikawalagala point.

Idamelle, a reef about 20 yards in length, and with from 5 to 6 feet water over it, is situated 2 cables north-westward of Dodampara rocks, and **Walapara**, a small flat-topped rock, on which the depth is 4 feet, is 2½ cables in the opposite direction from Dodampara rocks.

All these rocks, which lie parallel to the shore and are 3 cables off Kayikawalagala point, are surrounded by depths of from 3 to 6 fathoms.

A narrow ridge, on which the depths are from 3 to 4 fathoms, and with 7 to 8 fathoms along its outer edge, lies in a north and south direction off the coast, its northern end being one mile west-south-west of Kayikawalagala point.

Duwemodera lake, a small lagoon immediately behind the beach, is one mile southward of Arangala point, and Kosgoda village, long and straggling, is on its eastern side.

Communication.—Kosgoda is a station on the Coast railway.

Aspect.—Hilly country approaches the coast just mentioned, but the only summits easily distinguished are Duwemodera hill, isolated, 220 feet high, with a small ridge extending from it in an easterly direction; it is one mile eastward of Arangala, and fairly conspicuous.

Pelagas Kanda, the other summit, is 2 miles eastward of Kosgoda; it is flat-topped, and about 300 feet high, and rendered more remarkable by an isolated tree growing on it.

AHUNGALA POINT (*Lat. 6° 19' N., Long. 80° 2' E.*), nearly 8 miles southward of Bentota, is a cliffy eminence, from 60 to 70 feet high, and covered with cocoanut trees; on its inner part is a very large, dark, and conspicuous tree of umbrella form, which is the most remarkable object on this part of the coast, and in clear weather may be seen from a distance of 15 miles.

Kola islet, small, and with a few cocoanut trees on it, forms the southern part of Ahungala point, to which it is connected by a narrow strip of sand, covered at high water.

Dangers.—A small rock, awash, surrounded by depths of from 7 to 8 fathoms, lies 1½ miles north-westward of Ahungala point.

A bank, about 1¼ miles in length in a north and south direction, lies one mile off the coast immediately northward of Ahungala point; the least depth on it is 3½ fathoms, with 7 fathoms round.

A small head of 6 fathoms, surrounded by depths of from 12 to 14 fathoms, is situated 2¼ miles westward of Ahungala point.

Coast.—A low rocky promontory, covered with cocoanut trees, is situated about 1½ miles south-south-eastward of Kola islet, and nearly three-quarters of a mile beyond is Balapitiya point, a double point, low, flat, and planted with cocoanut trees; between it and Kola islet is a large boulder, 35 feet high, on the coast.

Madu Ganga, in reality a lake 3 miles in length and about 1½ in width, is close behind the coastline between Ahungala and Balapitiya points, and is connected with Randambe, a smaller lake to the south-

Chart 3700, Colombo to Galle. Var. 1° 10′ W.

ward of it. The entrance common to these two lakes is just northward of Balapitiya point, and only admits canoes; foul ground extends nearly 4 cables off it.

Ambalangoda (*Lat. 6° 14′ N., Long. 80° 3′ E.*) is $2\frac{1}{2}$ miles south-south-eastward of Balapitiya point, and between are a succession of small low rocky points, with sandy beaches; the line of cocoanuts, close to the water's edge, obstructs any view of the land behind.

Genawana, a rocky islet about a cable in extent and 25 feet high, has a square top, slightly vegetated, and is 3 cables off-shore at Ambalangoda.

A small bathing hut, painted red, is situated on the coast about half a mile east-south-east of Genawana islet, but it is not easily distinguished; behind it, at 20 feet above high water, Ambalangoda Rest house may be seen through the trees.

Ambalangoda village, which is large and joins Balapitiya village to the north, is on both sides of the Rest house, and there is a considerable fishing community.

Landing.—In fine weather landing may be effected on the northern side of Genawana island, but between it and the shore is foul ground, which breaks in ordinary weather.

Landing may also be effected, during the North-east monsoon, on a sandy beach between two points of rock immediately southward of Ambalangoda Rest house, and, although the sea appears to break across it, a small boat may enter with ordinary care.

Communication.—Ambalangoda is a station on the Coast railway.

Dangers.—For a distance of $1\frac{1}{2}$ miles north and south of Balapitiya point, rocky foul ground extends from a mile to $1\frac{1}{2}$ miles off-shore, and nearly out to the 10-fathoms contour line.

A 5-fathoms patch, surrounded by from $6\frac{1}{2}$ to $8\frac{1}{2}$ fathoms, is 2 cables long north and south and one cable wide; it lies $9\frac{1}{2}$ cables west-north-west from Genawana islet.

Two small rocks, the southern named Hirae, and having $3\frac{1}{2}$ fathoms water over them, are situated $1\frac{1}{2}$ and 5 cables respectively southward of Genawana islet; they have depths of from 5 to 7 fathoms around, and care is necessary to avoid them when approaching the landing place.

COAST.—Akorale point.—Patiagala, the southern point of the landing cove above mentioned, is 15 feet high, and on its northern side is the entrance to Madampe lake, a sheet of water about 2 miles in extent behind Ambalangoda; it is usually barred by sand, except in the rainy season.

General charts 813, 828, 70.

Chart 3700, Colombo to Galle. Var. 1° 20′ W.

Akorale point is 2 miles from Patiagala, with a sandy beach between, but at half a mile from the point the usual line of cocoanut trees is broken by a considerable gap, which is conspicuous from seaward, and through which is seen Delmar or Galgoda, a hill, 120 feet high, 1½ miles from the coast, and with a solitary tree on its summit.

Dangers.—From Patiagala point to Akorale point, rocky foul ground extends for three-quarters of a mile off-shore.

Passi rock (*Lat. 6° 11′ N., Long. 80° 3′ E.*), a dangerous dark-coloured rock, consisting of five heads, lies one mile westward of Akorale point, and is closely surrounded by depths of from 7 to 9 fathoms. One of the heads, about 2 feet above high water, always breaks, even in the finest weather; the southernmost head is awash, and the rest appear to have less than one fathom water over them.

Passi rock should be given a good berth, as the bottom is irregular for 3½ cables westward of it; and although a deep channel exists between it and the shore, it should not be attempted, as the water is shoal for 4 cables off Akorale point, and the bottom foul.

COAST.—From Akorale point, the coast trends to the south-eastward for 2½ miles, and then to the southward for half a mile to Telwatta point, which consists of several large, but low, rocks, and has the ruins of a large temple on it, but not conspicuous. Foul ground extends about a mile off this coast, the outer rock, with a depth of 2¼ fathoms, and 4¾ to 5 fathoms around, lying 1½ miles north-westward of Telwatta point.

Hikkaduwa point, 1½ miles farther south, is low, flat, and covered with cocoanut trees: a rest house on the point is almost hidden by trees. Hikkaduwa village, which is large, occupies the sides of the road northward of the point.

Communication.—Hikkaduwa is a station on the Coast railway.

Debaha rock, black, double-headed, and 4 feet above high water, lies 3½ cables westward of Telwatta point.

Waal islet, 30 feet high, is a large group of rocks with flat tops, somewhat conspicuous from seaward; it lies on the outer edge of the foul ground extending from Hikkaduwa point.

Landing may be effected in fine weather, in a small bay to the northward of Waal islet, passing through, or over, the coral reef which crosses its entrance.

Dangers.—A bank, 4 cables long in a north-east and south-west direction, and 2½ cables wide, with a least depth of 3 fathoms over it and 5½ to 7 fathoms around, lies about 1¾ miles north-west of Telwatta

General charts 813, 828, 70.

point, and close to the southward of it is another, on which the least depth is 2¼ fathoms with from 6 to 7 fathoms round.

Hikkaduwa Gala, a rock with less than one fathom water over it, lies on a shoal half a mile in extent, and about 1¼ miles south-south-eastward of Waal islet; it is surrounded by depths of from 6½ to 12 fathoms, and about a quarter of a mile northward of it is a small patch of 2½ fathoms.

Angala, three rocks awash, are inside and south-east of these dangers.

DODANDUWA POINT (*Lat. 6° 6′ N., Long. 80° 8′ E.*), about 2½ miles south-eastward of Waal islet, is low and terminates in Manda Gala and Mada Gala islets; the former islet is continued seaward to a rocky point, 12 feet high, which with a clump of cocoanut trees on the inner part serve to distinguish the locality.

Ratgama lake discharges northward of the point, its entrance being barred by sand, except during the wet season. Dodanduwa village is on the road chiefly eastward of the point; there is a Custom-house but very little trade.

Communication.—Dodanduwa is a station on the Coast railway.

Landing.—In the small bay, where is the entrance to Ratgama lake, boats can land in fine weather, but the approach is rocky, and there is always considerable surf. This and Ambalangoda are the only places on the coast from Beruwala where it is recommended that boats should land, and then only in the North-east monsoon.

Dodanduwa Gala, awash at low water, and always breaking, lies 2 cables west of Manda Gala islet.

Orava rock, on which the depth is 1½ fathoms is situated one cable north-north-westward of Dodanduwa Gala.

Goda Gala, a small rocky patch with a least depth of 4½ fathoms, and from 11 to 20 fathoms round it, is near the edge of the 20-fathoms contour line, and 1½ miles south-south-westward of Manda Gala islet: vessels should pass westward of it.

Tides.—It is high water, full and change, at Dodanduwa, at 1h. 50m.; springs rise 1½ feet.

Coast.—The coast from Dodanduwa to Galle, a distance of about 7 miles in a south-east direction is formed by a brown sandy beach, with rocky projections at intervals, and is low, with hills rising to heights of from 140 to 230 feet behind. The whole shore line is thickly planted with cocoanut trees, and the hill slopes are densely wooded.

Heavy rollers occur off this coast, throughout the whole distance, extending from 2 to 5 cables from it so that it is impossible for a boat to land at any time, and there are just a few places used by native canoes.

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Plan of approaches to Galle harbour on 819 Var. 1° 20' W.

Bataina Gala (*Lat. 6° 3' N., Long. 80° 11' E.*), the first point of any importance is nearly 4½ miles from Dodanduwa; it is 45 feet in height, rising behind to 60 feet, crowned with cocoanut trees, and somewhat conspicuous.

It is on the eastern side of the entrance to Gin Ganga, a river 70 miles in length, which at 31 miles from its mouth flows past the foot of Hiniduma Kanda.

Gintota Palama, a narrow sandy spit, 4 cables in length, fronts the entrance, the river finding its exit by a narrow channel round its eastern end during the dry season, but this channel is considerably altered during floods.

Boats, and, generally, canoes are unable to enter from seaward, on account of shallow rocky flats and dangers, which break heavily in the surf, but inside the river is navigable for river boats, for about one half of its length. Baddegama and Udugama are sugar and tea-planting districts on its southern bank.

Nindan Godella, a small rocky projection, 18 feet high, is nearly 1½ miles south-eastward of Bataina Gala; it may be known by the Public Works Department bungalow, a white house, on its summit.

About 4 cables farther south-eastward is the entrance to Mahámodera lake, usually barred by sand; its position is pointed out by an iron girder road bridge which crosses it.

The Government hospital, a long building of two storeys, with stone pillared verandahs, painted a light buff colour, is 3 cables south-eastward, and not being obscured in any way, is very conspicuous.

Galu Gala, a bank with a least depth of 18 fathoms, much frequented by fishermen, lies 3 cables inside the 30-fathoms contour line, and 3 miles south-westward of Point de Galle lighthouse.

APPROACHES TO GALLE HARBOUR.—Dangers. --The principal dangers in the western approach to Galle harbour are:—

Mada Gala (Gindura rock), a patch of rock, 2 cables long and one wide, with less than 6 feet water over it, lies 2 miles south-westward of Bataina Gala; it is fairly steep, and situated at the western end of a bank, on which the depths are less than 10 fathoms, lying parallel to the shore, and 8 cables long and 3½ cables wide.

Depths of from 12 to 13 fathoms are found at a distance of half a mile north-westward of the edge of this bank, and the 20-fathoms contour line passes parallel to it, and a quarter of a mile seaward of the rock.

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Plan of approaches to Galle harbour on 819. Var. 1° 20′ W.

Buoy.—A red conical buoy, surmounted by a staff and globe, is moored in a depth of 18 fathoms 3¼ cables southward of the rock, but it sometimes breaks from its moorings, in which case the rock is a serious danger, as, although it breaks heavily in the South-west monsoon, in moderate weather or in a calm it is not so easily distinguished.

Ala Gala (Whale rock), with less than 6 feet water over it, is 1¾ cables long, in a north and south direction, and one cable broad. It lies 1 8/10 miles southward of Bataina Gala, is surrounded by depths of about 6 fathoms, and has 7½ fathoms a quarter of a mile outside it; the rock is marked by breakers in both monsoons, and should have a berth of 3 cables when passing it.

Alu Gala (Little Whale rock), 3 feet high and steep-to, with depths of from 6 to 7 fathoms close round it, lies one mile southward of Nindan Godella.

Clearing mark.—Point de Galle lighthouse bearing E. ⅞ N. leads southward of Mada Gala, Ala Gala, and Alu Gala rocks.

CAUTION.—Implicit reliance should not be placed on any buoys marking outer dangers in the approaches to Galle harbour, as they are liable to break adrift.

Goda Gala (Bellows reef), the outer danger on the eastern side is a rocky patch, with less than 6 feet water over it, 1¾ cables long and one cable wide, and always breaking; there is a passage inside it for boats, and the 10-fathoms contour line passes close outside it. It lies 7 cables south-south-eastward of Unawátuna point, immediately eastward of which are rocks and foul ground.

Inner rocks.—Within or on the edge of the foul ground which fronts the shore inside these outlying dangers are several rocks above water, none being particularly conspicuous. They lie at the following distances from Bataina Gala:—

Manuan Gala (*Lat. 6° 4′ N., Long. 80° 10′ E.*), 10 feet high, close to the beach, 1 2/10 miles north-west; Lihini Gala (Gull rock), 3 feet high, 2¼ cables from the beach, 8 cables north-westward.

Pedruana Gala, two rocks close together, the outer 3 feet high and flat-topped, the inner 6 feet high and pointed; they lie 4 cables southward, and at three-quarters of a mile south-eastward of the same point is a black boulder 8 feet high.

Other rocks above water and dangers will be best seen from the chart.

Charts 3700, 819.

Directions.—Between Bentota and Galle vessels should keep outside the 20-fathoms contour line, or about 6 miles from the land, and

Plan of approaches to Galle harbour on 819. Var. 1° 20′ W.

at that distance there are few objects for fixing a position, the most prominent, near the coast, being the monument on Galboda Kanda (in the afternoon), the dark umbrella-shaped tree on Ahungala point, and Waal island. (*View A on 3700.*)

If visible, Hiniduma Kanda (the Haycock) is conspicuous, and Hindelunattu, 11½ miles north-eastward of Galle, though its summit is ill defined, forms a valuable mark when eastward of Waal island, as does also Katukurunda, an islet which, when seen from the westward, appears as a tuft rising over the extreme point of low land to the eastward of Galle.

Other objects are Point de Galle lighthouse and Edwards pillar, 245 feet above high water, painted white with a black top, and standing on the summit of Rumassala Kanda, on the eastern side of Galle harbour.

Point de Galle lighthouse bearing E. ⅞ N. leads about 1¾ miles southward of Mada Gala, and three-quarters of a mile in the same direction from Ala Gala, and when the bell buoy of the entrance is seen it may be steered for.

Sailing vessels approaching Galle harbour should be kept in a weatherly position in order to be able to fetch in, bearing in mind that the current, during the South-west monsoon, sets to the eastward along the coast at a considerable rate, and in a contrary direction during the North-east monsoon.

A sailing vessel set to leeward of the port during the South-west monsoon might take even weeks to regain a position to enter the harbour, and instances have occurred where they have either been compelled to run for Trincomalí or to re-cross the equator.

Plan of Galle harbour on 819.

POINT DE GALLE (*Lat. 6° 1′ N., Long. 80° 13′ E.*), a promontory which projects for about half a mile from the general line of coast, immediately eastward of the Government hospital (already described), is entirely surrounded by a fortification wall, built by the Dutch during their occupation, and is joined to the mainland by a low, flat isthmus. (*View on 819.*)

Foul rocky ground extends off the point for a quarter of a mile in all directions.

Aspect.—The town standing within the walls has cocoanut palms and other trees amongst the houses, but on the western side the point is clear and grassed over. The principal objects are:—

The clock tower, a square stone erection resembling a factory chimney, which stands on the highest part of the peninsula, its top being 141 feet above high water.

General charts 3265, 3700, 813, 828, 70.

Plan of Galle harbour and approaches on 819. Var. 1° 20′ W.

The Roman Catholic chapel, a large and very conspicuous building, painted white, with two towers on its front facing the sea, and a dome on the other end, the tops of each being 139 feet above high water; it stands on a hill a little way behind the town, but on the main land. All Saints church, with a square tower, surmounted by a four-sided pointed red roof, and a large weathercock, is in the centre of the town on the point.

A mosque, recently built, is a large two-storeyed building, painted white, with two small domes and several short minarets; it is situated at the south-east corner of the point.

Behind the town, low woody hills extend for a considerable distance, of which only Residency hill, 203 feet high, covered with trees and situated somewhat to the eastward and behind the Roman Catholic chapel; and Hirimbure Kanda, conical, 250 feet high and with two large, dark banyan trees on its eastern side and about 2 miles inland, are likely to be recognised by a stranger.

LIGHT (*Lat. 6° 1′ N., Long. 80° 13′ E.*).—On the south bastion of the fort is a cylindrical iron tower, 80 feet in height, and painted white, from which is exhibited, at an elevation of 100 feet above high water, a *white group flashing* light, with a period of system of *thirty seconds*, showing two flashes, thus:—flash, *two seconds;* eclipse, *three seconds;* flash, *two seconds;* eclipse, *twenty-three seconds.* It should be visible in clear weather from a distance of 15 miles.

Lloyd's Signal station.—The signal station is on Neptune's bastion, about a quarter of a mile north-westward of the lighthouse, near the parapet of the wall.

Signals.—Vessels passing at night and showing the Company's Night signal will be reported, and those wishing to indicate that the port of Colombo is their destination, should display a *red* light aft.

Vessels in distress and requiring assistance should hoist the flags N.C. of the International Code, or the distant signal of a square flag over a ball, by day; and by night, fire minute guns, single rockets at short intervals, or burn a tar barrel.

Outer anchorage.—Hiniduma Kanda, in line with Point de Galle lighthouse bearing N. 16° E., leads to the outer anchorage, and during the North-east monsoon the best berth is in a depth of 15 fathoms, over sandy bottom, with the summit of Hirimbure Kanda and the lighthouse in line, N. 7° E., and Ereminia Gala, a somewhat prominent rock on the first bend of the coastline, eastward of Unawátuna point, bearing E. ½ S.

During the South-west monsoon vessels should not anchor in the road, but the best temporary anchorage is in 16 fathoms water, with the lighthouse bearing N.E., distant about 1½ miles.

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Plan of Galle harbour and approaches on 819. Var. 1° 20′ W.

Anchorage anywhere to the eastward of the bell buoy, although equally safe, is not advisable on account of the swell, which, at any season of the year, is much more felt as the rocky coast to the eastward is approached.

Plan of Galle harbour on 819.

GALLE HARBOUR (*Lat. 6° 1′ N., Long. 80° 13′ E.*), entered between Point de Galle, on the west, and Watering point, on the east, which are one mile apart, is about 1½ miles in width in an east-south-east and opposite direction, and recedes about one mile.

The eastern side of the harbour, formed by Rumassala Kanda, a large wooded hill, 245 feet in height, having on its summit Edwards pillar, 50 feet in height, painted white with a black top, slopes down to the sea, and is terminated, on the harbour side, by cliffs from 60 to 70 feet high, which become lower towards the southern part.

Watering point, a spur, projecting from about half-way down the western side of Rumassala Kanda, has a cliffy face to seaward, and near its extreme, at 100 feet above high water, is a stone structure, about 10 feet in height and painted white, which forms the front leading mark when used with Edwards pillar; it is conspicuous, especially in the afternoon sunlight.

On the northern part of Rumassala Kanda is a plantation of cocoanut palms, amongst which are the buildings of Buona Vista Orphanage, not easily distinguished; and at the southern end of the same hill is another plantation, above Unawátuna point, precipitous, rocky, and from 40 to 50 feet high.

In the small bay immediately northward of Watering point is a pier, on which is a pipe from which water can be pumped for the use of shipping, and a small white buoy is moored off its end for the convenience of boats watering, but care is necessary in approaching, as several sunken rocks exist in the neighbourhood.

The shore of Galle harbour is a curving sandy beach, broken by two rocky points named Gibbet island and Closenberg, neither of any height, but the former has on it cocoanut palms and the latter a large European bungalow.

Behind the points the beach is low and flat, and entirely overgrown with cocoanut palms, about 80 feet high, but at one position, a little to the northward of Gibbet island, there is a short break in the trees, and in it a low white wall, about 200 feet long, fronting a somewhat large but not conspicuous building, used as an oil store; the white wall, easily seen from seaward, forms a mark for entering.

The country behind the beach is generally flat, but becomes more hilly to the northward, and among these hills is Kurundu Kanda, flat-topped, 294 feet high, and cleared for a tea plantation; one tall tree left standing, near its western end, is visible from the entrance to the harbour.

A little to the eastward, and 17 miles inland, of Kurundu Kanda is Hiniduma Kanda (the Haycock), and on clear mornings in the early months of the year Adam's peak will appear a little to the right of it, as a sharp and regular cone, rising above the surrounding mountains, and flanked by a series of lesser peaks, apparently on the shoulders of its slopes.

Dangers.—Western side.—Kadda rocks (*Lat.* 6° 1′ *N.*, *Long.* 80° 13′ *E.*).—Three disconnected patches, named the Outer, Middle, and Inner Kadda rocks, the outer being 7 cables south-south-eastward of Point de Galle lighthouse, lie in a north and south direction, and have depths of 2, 1¾, and 2 fathoms respectively over them; during the South-west monsoon the sea breaks heavily over their whole length, but in the North-east monsoon there is seldom any disturbance of the surface.

Bell buoy.—A bell buoy, painted red, is moored in 12 fathoms water, $2\frac{2}{10}$ cables southward of the Outer rock. (*View on 819.*)

Clearing mark.—Ereminia Gala point well open of Unawátuna point, bearing S. 80° E., leads southward of the rocks.

CAUTION.—Should the bell buoy not be in position, a signal to that effect is made from the signal station, but under any circumstance implicit reliance should not be placed on the buoys being in the positions assigned to them.

Sealark rock, with 3½ fathoms water over it, lies three-quarters of a cable north-eastward of Inner Kadda rock, with depths of 9 fathoms between.

Buoy.—A can buoy, painted black, marks the southern side of the rock.

Mée Meti Yawa, on which the depth is 2½ fathoms, lies midway between Inner Kadda rock and Kakoni rocks, and 2 cables from the latter; the sea breaks on Mée Meti Yawa in bad weather.

Polkote Gala, with 3 feet water over it, and on which the sea breaks, is situated $3\frac{6}{10}$ cables east-south-east of the lighthouse. Midway between Mée Meti Yawa and Polkote Gala is a patch of 2½ fathoms.

Buoy.—A spherical buoy, painted black, is moored in 6¾ fathoms water, close eastward of Polkote Gala.

Belikatu Wawa, lying 1¼ cables northward of Polkote Gala, has a depth of 2 fathoms over it, and breaks during bad weather in the South-west monsoon.

Plan of Galle harbour on 819. Var. 1° 20′ W.

Buoys.—A spherical buoy, painted black, is moored in a depth of 6 fathoms, three-quarters of a cable north-eastward of Belikatu Wawa.

A similar shaped and painted buoy is moored with Polkote Gala and Belikatu Wawa buoys in line, and 1$\frac{2}{10}$ cables from the latter.

Welihukka, northward of Belikatu Wawa, and on the western side of the harbour, is a rocky patch, with depths of from 3 to 6 feet over it, extending for three-quarters of a cable north and south, and breaking in moderate weather.

Buoy.—A spherical buoy, painted black, is moored in 4 fathoms water, half a cable eastward of the northern part of the patch.

Eastern side.—Alut Ground (*Lat. 6°1′N., Long. 80°14′E.*), on which the depth is 6¼ fathoms, is situated 5½ cables east-south-east of Outer Kadda rock.

Secundra rock, on which is the wreck of the steamer of the same name, has a least depth of 5 fathoms over it, and lies 2½ cables east-north-east from Outer Kadda rock.

Buoy.—A buoy, painted green, is moored south-westward of the rock.

Gal Pare, three heads with 4¼, 4½, and 4¾ fathoms water over them respectively, is situated from one cable to 1$\frac{3}{10}$ cables north-eastward of Secundra rock.

Bloomfield rock, on which the depth is 4¼ fathoms, and with 7 fathoms around, is very small, and lies 1¾ cables north-eastward from Sealark rock.

Buoy.—A can buoy, painted red, marks the western side of Bloomfield rock.

Imbu Ranne Gala, three small heads of 4¾, 4¾, and 4¼ fathoms over them respectively, from south to north, lie in a north-north-east direction, with depths of 6½ fathoms between; they are situated 3⅓ cables westward of Watering point.

Diya Mudawa, with 1¾ fathoms water over it, is 5¼ cables west-north-west of Watering point, and breaks in the South-west monsoon.

Buoy.—A can buoy, painted black and white in checks, is moored in a depth of 7 fathoms, one cable south-westward of Diya Mudawa.

Matte Mada, two patches, with depths of 1¼ fathoms on the southern and 5 feet on the north-western, are half a cable apart and 4¾ cables eastward of the lighthouse; the sea constantly breaks on these rocks.

Buoy.—A can buoy, painted red marks the western side of the north-western rock.

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Plan of Galle harbour on 819. Var. 1° 20′ W.

Wara Galwala, on which the sea breaks, has a depth of 3 feet over it, and is situated one cable north-eastward of Matte Mada.

Katta Gala.—A long ledge, named Katta Gala, extends in a southerly direction from near the southern end of Gibbet island, and has shoal spots of 5 feet, 2½ and 2¾ fathoms on it, with a patch of 3 fathoms lying between it and Wara Galwala.

Buoy.—A spherical buoy, painted red, is moored in 5¼ fathoms water, three-quarters of a cable westward of the 5-foot patch.

The remainder of the dangers in the harbour, being out of the usual route taken by vessels, are not described, but their positions will be seen on the plan.

Entrances.—There are three passages into the harbour, viz., the Western, Central, and Eastern, of which the Central is the best and that almost always taken by the pilots.

Western entrance (*Lat. 6° 1′ N., Long. 80° 13′ E.*).—The western entrance between the shoal water extending northward of Inner Kadda rock and Mée Meti Yawa is only about half a cable in width between the 5-fathoms patches.

Depths.—There are depths of from 33 to 35 feet in the western channel.

Directions.—Edwards pillar in line with the white tower on Watering point, bearing N. 88° E., leads between Inner Kadda rock and Mée Meti Yawa until the Roman Catholic chapel comes in line with the lighthouse, N. 20° W., when alter course to N. 65° E. for Gravet point, the north-west extreme of Rumassala peninsula, and when Lloyd's flagstaff is in line with the lighthouse, N. 45° W., steer N. 14° E. for the white wall of the Government oil store to the inner anchorage, leaving the black buoys on the port and the red buoys on the starboard hand.

Central entrance.—The central entrance is between Sealark rock, Polkote Gala, and Belikatu Wawa, on the western side; and Secundra rock, Bloomfield rock, and Matte Mada on the eastern side, and is about three-quarters of a cable wide at its narrowest part, between Belikatu Wawa and Matte Mada.

Buoys.—The shoals on the port hand are marked by spherical buoys, painted black, and those on the starboard hand (except Secundra rock, which has a wreck buoy) by spherical buoys, painted red.

Depths.—The depths are from 7 to 9 fathoms in the outer part of the channel, about 6 fathoms at the narrowest part, and shoaling from that to the anchorage.

Directions.—From a position about 1½ cables eastward of the bell buoy (*View on plan 819*), steer N. ¼ E., between Secundra and

Plan of Galle harbour on 819. Var. 1° 20′ W.

Sealark buoys, and until a little past the buoy marking Polkote Gala, and the Roman Catholic chapel is in line with the Sun bastion, which is the north-east corner of the highest part of the fort, bearing N. 37° W., when alter course to N. 14° E., for the white wall, and proceed as before directed.

Eastern entrance (*Lat. 6° 1′ N., Long. 80° 13′ E.*).—The eastern channel is between Bloomfield rock, on the south-west, and the black and white chequered buoy marking the south-west side of Diya Mudawa, on the north-east side.

Depths.—The depths are from 6¾ to 8 fathoms, in the outer part of the channel, and until past Polkote Gala, from which they shoal to the anchorage.

Directions.—Having rounded the dangers off Unawátuna point, bring the Roman Catholic chapel in line with the Sun bastion, bearing N. 37° W., and after passing Polkote Gala follow the directions already given.

Note.—Vessels cannot enter the harbour by night, and the pilots are only allowed to take vessels out at that time in cases of extreme emergency.

Pilots.—Pilotage, by a Government pilot, is compulsory on all vessels entering or leaving the harbour, except native craft, and no vessel is allowed to enter, leave, or to move in the harbour between the hours of sunset and sunrise, without permission of the harbour authorities.

The signal for a pilot, by day, is the pilot flag of the vessel's nationality, or the flags P T of the International code; by night a *blue* light should be burnt *every fifteen minutes*, or a bright *white* light flashed for about *one minute* at a time.

Vessels should wait the arrival of the pilot to the southward of the Kadda rocks bell buoy; the boats are native outrigger canoes, which have *Government pilot* painted on each side, the letter P on the sail, and a red and white flag at the masthead.

Rates of Pilotage.—Vessels entering or leaving are required to pay pilotage, even if no signal for a pilot is made. The rates are:—

Vessels up to 99 tons - - - -	Rs.7.50
Vessels from 100 to 199 tons - -	Rs.11 25
Vessels from 200 to 399 tons - -	Rs.15.0
Vessels from 400 to 599 tons - -	Rs.22.50
Vessels of 600 tons upwards - -	Rs.30.0

Anchorage.—The anchorage in the harbour is in about 5 fathoms water, over sand and mud bottom, with good holding ground. The berthing is in the hands of the pilot, and all vessels are required to moor head and stern, and should be ready to veer on both cables if required. The harbour authorities provide stern moorings, and will lay out the anchors if desired, but a charge is made for the moorings.

Tides.—It is high water, full and change, in Galle harbour at 2h. 3m.; springs rise about 2 feet, but both high and low water heights are affected by diurnal inequality.*

TOWN (*Lat. 6° 1′ N., Long. 80° 13′ E.*).—The town, enclosed by a wall, is entered by two gates, one facing the landing place, and the other on the northern side, leading to the flat, grassy isthmus, now the racecourse. Built during the Dutch occupation in the seventeenth century, it is divided by narrow, straight streets, the houses closely adjoining each other, as in a European town. The principal buildings have been already noticed.

Other buildings, conspicous after entering the harbour, are the hotel, a large, two-storeyed house, standing on high ground on the eastern side of the town; next to it is an old Dutch church, with two high ornamental gables, which is painted white, but its south-west side has become blackened by the weather.

The native town and the bazaar stretch along the main coast road for about 2 miles east and west of the racecourse, and front the commencement of the various roads which lead northwards to the country. The Government Agent's official residence, on the summit of Residency hill, is completely obscured from the harbour by trees.

The site of the present town was that of a fishing village in 1505, which was fortified by the Portuguese, who built a wall across the isthmus, the present wall and fortress being added by the Dutch in 1667; the fortress was surrendered to the British in 1795.†

Population.—The population of the town and the native portion extending to the westward along the shore of the bay was 39,624 in 1907, of which 124 were Europeans.

Communication.—Three lines of steam vessels frequent the port, viz., the Asiatic, the British India, and the Clan, and the arrivals and departures in the year amount to about 150 in number.

There is railway communication with Colombo and to the eastward with Matara, the railway station being at the north-west corner of the racecourse. Telegraphic communication with all parts, through Colombo.

Coal and supplies.—About 3,000 tons of Indian coal are kept in stock, and 15,000 tons imported annually, and there are

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* Full predictions for the tides are published annually in the Indian Tide Tables, Part II.

† The derivation of the name Galle, pronounced in two syllables in Sinhalese, is uncertain, and cannot be referred to any existing word in that language.

Plan of Galle harbour on 819. Var. 1° 20′ W.

70 lighters, holding 10 tons; vessels can be coaled at the rate of 900 tons in 24 hours, there being only about 5 or 6 days in the year that coaling is interrupted by bad weather.

Fresh provisions, as beef, mutton, bread, and vegetables are fairly plentiful, and may be procured in reasonable quantities.

Water is brought into the town through pipes from a reservoir, but that obtained from the well at Watering point (page 119) is not of good quality during the dry season, in March and April. There are three water boats owned by private firms who undertake to provide vessels with water.

Hospital (*Lat. 6° 2′ N., Long. 80° 12′ E.*).—The seamen's ward in the Government hospital has six beds, and accommodation can be found elsewhere for more than that number if required.

Quarantine.—Vessels not having properly qualified medical officers, are prohibited from communication with the shore, nor is any other person but the pilot allowed to board them until permission is obtained from the health officer, and under no circumstances are cases of infectious disease allowed to be landed without the knowledge and consent of the Government health officer.

The regulations governing vessels having plague, cholera, or yellow fever on board, and the signals required from all vessels arriving off the port, are the same as those for Colombo. *See* page 101.

Trade.—The principal exports, consisting of cocoanut products, citronella oil, tea, cinnamon, and plumbago, amounted to £221,607; and imports, of foodstuffs, as rice, and other grain, sugar, curry, and coal, to £101,659, in 1906.

Climate.—The climate is hottest and most trying during March and April, before the break of the South-west monsoon, but at no time can it be considered unhealthy.

Plan of approaches to Galle harbour on 819. Var. 1° 20′ W.

COAST.—The coast to the eastward of Unawátuna point recedes and forms a sandy bay, half a mile long, on the shores of which are houses among cocoanut palms; one of these, on the coastline at the eastern end of the bay, is large, painted white, and conspicuous. Eastward of this house the coast is fronted by a sea wall for the preservation of the road, which here runs along the shore.

Reef.—A reef of rock and coral stretches across the mouth of the bay above mentioned, with a small space at its western end by which canoes can reach the shore; the reef, widening to the eastward, has a ledge of black rock, three-quarters of a cable long, and 8 feet high, standing out a little distance from the shore.

General charts 3265, 3700, 813, 828, 70.

Plan of approaches to Galle harbour on 819. Var. 1° 20′ W.

Talpe (*Lat. 6° 0′ N., Long. 80° 15′ E.*) is the name of this district, and behind the coast is Talpe Kanda, a hill 290 feet high, flat topped, and completely wooded, with a second hill, 251 feet, joined to its eastern side by a ridge, and having a fairly marked summit. Pilagoda dagoba, painted light blue, and nearly surrounded by trees, is about two-thirds up its southern slope.

A well-marked gap between Rumassala Kanda and Talpe Kanda has very steep sides, falling abruptly to a narrow level space about 20 feet above high water, and through which, in clear weather, Hiniduma Kanda and Adam's peak may be seen on a North bearing.

Ereminia Gala point, 8 cables eastward of the white house, previously mentioned, is a large black rock on the beach, 20 feet high, with pointed top; another and rather conspicuous boulder, 30 feet high, is near high-water mark on the beach, 2 cables farther eastward, the shore between being sandy and backed by cocoanut palms.

Communication.—Talpe station, on the line between Galle and Matara, is three-quarters of a mile eastward of Ereminia Gala point.

Chart 3700, Colombo to Galle.

COAST.—From the last-mentioned boulder the coast, trending in an east-south-east direction, is a slightly irregular sandy beach, fronted by a rocky or coral reef, parallel to the shore; the sea breaks heavily at various distances off the beach, which is backed by a thick fringe of cocoanut palms, with the railway and the coast road running through them.

About 1¼ miles northward of Talpe station is Malagoda Kanda, a conical hill, 304 feet high, with a well-marked tree on its summit, and a shoulder extending south-westward, the summit of which is 257 feet; both are somewhat conspicuous.

Koggala lake, lying behind the coast about 4 miles eastward of Ereminia Gala point, is 2½ miles long in a north-west direction, and one mile broad; the water is fresh, and the small outlet, situated 4½ miles from Ereminia Gala point, may be known by a solitary black rock, 50 feet high, named Kotavanni, which is near the western entrance point and fairly conspicuous.

About 2 miles inland behind Koggala lake hilly country commences, and gradually increases in height to Hindelunattu, a large rounded summit, 1,344 feet high, with a small pointed shoulder on its north-east side; when once distinguished it is a conspicuous object all round the southern and western coasts.

Landing.—About a mile westward of Kotavanni is a landing place for canoes, and another may be reached through the reef about half a mile eastward.

General charts 3265, 3700, 813, 828, 70.

Chart 3700, Colombo to Galle. Var. 1° 20′ W.

Katukurundu (*Lat. 5° 58′ N., Long. 80° 23′ E.*), an islet, the trees on which have tufted tops and are 130 feet high, is situated 3¼ miles eastward of Kotavanni; it is cliffy and joined to the shore by a causeway, three-quarters of a cable in length. A prominent reddish cliff, from 70 to 100 feet high, with boulders at its foot, projects from the coast at 6 cables westward of the islet.

Reef.—A rocky reef, with heads above water, extends 2 cables south-eastward of the islet.

Off-lying dangers.—Between Unawátuna point and Katukurundu islet, a distance of 8½ miles, the whole coast is bordered by a reef, with foul ground extending 3½ cables in places, and on which the sea breaks all the year round.

Outside the breakers the soundings are somewhat irregular in places, but, with the exception of a 5-fathoms patch, surrounded by depths of 9 and 10 fathoms, which lies 6½ cables south-south-westward of Kotavanni, there appear to be no actual out-lying dangers. Debaha rock, lying 3 cables off-shore abreast Kotavanni, is small, 3 feet high, and has depths of from 4½ to 6 fathoms around it.

Chart 3265, Galle to Little Basses.

COAST.—From Katukurundu to Rasamunai point the coast, trending in an east-south-east direction, is sandy and backed by cocoanut palms, the road running close to it till within about half a mile of the latter, when the land becomes somewhat elevated, and the red cliffs form a conspicuous object.

Except at a point a little more than one mile eastward of Katukurundu, where the shore reef extends off for a distance of 1¾ cables, it is close to the beach.

Plan of Weligama bay on 3730.

Weligama bay, entered between Rasamunai and Mirissa points, is about 1½ miles in extent, the two points being 1$\frac{6}{10}$ miles apart.

Rasamunai point, on the western side of the entrance, is composed of red cliffs, which extend half a mile to a point to the westward and as far as Weligama point, about a third of a mile north-north-eastward; from this latter point round to Polatu Ganga, in the north-east corner of the bay, the coast is sandy and backed by cocoanut palms, interrupted by only one cliffy point, about 4 cables northward of Weligama point, and on which is a small white house.

From Kada point, on the eastern side of the bay, and immediately southward of the Polatu Ganga entrance, to Wera point, nearly half a mile south-south-west, the coast is cliffy, of moderate height, and red in colour; at Wera point the cliffs attain a height of 90 feet.

Plan of Weligama bay on 3730. Var. 1° 20′ W.

Mirissa point, about 1⅔ miles east-south-east of Rasamunai point, is the western extreme of a moderately elevated peninsula, partly planted with cocoanut palms; Kola point, the eastern extreme of this peninsula, is 6½ cables south-eastward of Mirissa point. Mirissa village is situated in a sandy bight between Wera and Mirissa points.

The district lying immediately behind the head is so low as not to be seen from the bay, but hilly country, commencing about 3 miles inland, is seen over the cocoanut palms, extending to Hindelunattu to the north-westward, and, to the north-eastward, Gongala is visible in clear weather, with ridges of hilly country between.

Depths.—Between the entrance points and the several dangers existing on that line the depths are from 7 to 8 fathoms, and depths of from 5½ to 6½ fathoms extend in the bay for about two-thirds of a mile, but inside that, and the 5-fathoms contour line, they shoal gradually to the shore, between the various shoal patches.

Islets and dangers.—The following are the principal islets and dangers, and, regarding the latter, it should be noted that the sea may break with a south-westerly swell on any shoal patches which have no greater depth than 3 fathoms over them.

Western side.—Yala rock, small and steep-to, with a least depth of 1½ fathoms over it, lies about half a mile south-westward of the western part of Rasamunai point.

From half a mile westward and round Rasamunai point, for more than half a mile northward of it, is a reef with a few rocky heads above water, which is always breaking, and extends from 2 to 3 cables off-shore.

Pares shoal, on which there is a least depth of 2½ fathoms, is about half a mile south-eastward of Rasamunai point, with the 5-fathoms contour line extending fully a cable further in the same direction, and between the shoal and the reef just mentioned the bottom is very uneven.

Sealark rock, lying nearly midway on a line between Rasamunai and Mirissa points, has a least depth of 4¾ fathoms over it, and Kada rock, on which the depth is 2½ fathoms, is on the same line, and nearly 2 cables east-south-east of Sealark rock.

Karamas rock, with 3¾ fathoms water over it, is situated nearly 9 cables eastward of Rasamunai point.

Ruwana rock, small and 6 feet high, is 3½ cables eastward of Weligama point; a small rocky head, awash, lies immediately eastward of the rock.

Pigeon island (*Lat. 5° 58′ N., Long. 80° 26′ E.*), 53 feet high, and at the head of the bay, is rocky, covered with scrub, and may

Plan of Weligama bay on 3730. Var. 1° 20′ W.

be distinguished by its having no cocoanut palms on it. Gan island, 41 feet high, and situated about 4½ cables westward of Pigeon island, is nearly connected with the main island by sand at low water, and, being planted with cocoanut palms, is not so easily distinguished from the main island. The dangers in the vicinity of these islands are best seen from the plan.

Eastern side.—On the eastern side of the entrance between Mirissa and Kola points, are several rocks, lying off the coast, with a considerable amount of foul ground, inside the 10-fathoms contour line.

Palapana gala, shoal rocky ground on which the least depth found was 3¾ fathoms, lies 4 cables southward of Mirissa point, and a rocky patch of which the depth is 2¾ fathoms, is situated about 2 cables south-south-east of Kola point.

Diyumba alut rock, with 2¾ fathoms least water over it, on which the sea breaks occasionally, is 3 cables westward of Mirissa point, and the highest part of a rocky ridge, which extends 2 cables in an east-north-east and opposite direction, with depths of from 5 to 6 fathoms between it and the point.

Diyumba rocks, about half a mile northward of Mirissa point, is a cluster, of which the western has a depth of 2¾ fathoms, and the northern 2 fathoms; the least water over them 1¼ fathoms, and their positions, and also other rocks north-eastward of them, will be seen on the plan.

Prompt shoal, with a least depth of 2¾ fathoms over it, lies 4¾ cables south-south-east of Pigeon island, and nearly midway between this shoal and the island is Puhumodal rock, on which the depth is 1½ fathoms.

Great and Little Bolo rocks, 8 feet and 3 feet high respectively, are about a third of a mile north-eastward of Prompt shoal, and other dangers between them and the shore will be seen on the plan.

Anchorage (*Lat. 5° 57′ N., Long. 80° 26′ E.*) may be obtained either south-eastward of Ruwana rock, in from 5 to 6 fathoms water, over sand and rock, or in the south-east part of the bay, off Mirissa village, in the same depth, a good berth being with the highest part of Kada point in line with a square-topped tree, about a quarter of a mile inland, bearing N.E. ⅝ N., and Ruwana rock N.W. by W. ¾ W.

Although no reliable information could be obtained, it is probable that the former may be used during the South-west monsoon, but the latter anchorage was used by the surveying vessel in the months of January and February, and good shelter from the swell, which was setting into the former anchorage, was obtained.

General charts 3265, 813, 828, 70.

Plan of Weligama bay on 3730. Var. 1° 20′ W.

Directions.—From the westward Yala rock must be avoided, and from the eastward a vessel should pass southward of Prinz Heinrich shoal, for which clearing marks are given (*see* page 131). Proceed into the bay with Pigeon island in line with a gap in the black hills, bearing S. 6° W. (*View on plan 3730*), which passes 1½ cables westward of Diyumba alut rock and 1½ cables eastward of Kada rock, and after these are passed the anchorage off Mirissa village should be steered for.

If intending to anchor south-eastward of Ruwana rock, enter the bay on the same leading mark and pass northward of Karamas rock to the anchorage.

Tides.—It is high water, full and change, in Weligama bay at 2h. 17m.; springs rise about 2½ feet.

Town (*Lat. 5° 58′ N., Long. 80° 26′ E.*).—The town, situated on the north-west side of the bay, is somewhat scattered, and in 1901 had a population of 7,583; a resthouse is close to the shore westward of Gan island.

Communication.—Railway communication with Galle and Colombo to the westward and with Matara to the eastward; there is a post and telegraph office.

Landing.—The best landing place is on the south-west side of a sandy spit drying at low water, which extends from the shore towards Gan island.

Chart 3265, Galle to Little Basses.

COAST.—From Mirissa point to Dondra head, a distance of 8½ miles, the general trend of the coast is a little to the southward of east; probably owing to its being densely wooded with cocoanut trees, it appears to be moderately elevated.

There are several dagobas on this coast, which are conspicuous under favourable conditions of light, but at other times are often difficult to distinguish.

Depths off-shore.—Between the above points the bank of soundings extends on an average for about 4 miles off-shore, with the exception of a pocket of deep water south-westward of Dondra head, which brings the 100-fathoms contour line to within 2¾ miles of the coast, about 3½ miles west-south-west of Dondra lighthouse.

Inside the 5-fathoms contour line the bottom is rocky and uneven, and for purposes of ordinary navigation vessels should keep outside the 20-fathoms contour line, which, passing fully 1½ miles southward of Varagalle point, runs generally parallel to the general trend of the coast.

Current.—When proceeding to the westward and passing within a mile of Dondra head, the currents are irregular, and care is necessary to avoid an indraught into the bay immediately westward of the head, and in which there is a considerable amount of foul ground.

General charts 813, 828, 70.

Plan of Weligama bay on 3730. Var. 1° 20′ W.

Coast.—Kota point is on the eastern side of the peninsula, of which Mirissa is the western extreme, and between it and Veragalle point, rocky and situated half a mile eastward, is a small sandy bight, from the western part of which a rocky ledge, about 10 feet at its highest part, extends for a distance of a cable.

Prinz Heinrich patch, a large rocky patch, with a least depth of 4 fathoms over it on its western edge, lies $1\frac{6}{10}$ miles south-south-eastward of Mirissa point; from its eastern side depths of from 6 to 10 fathoms extend for a distance of half a mile.

Clearing marks.—Brown's hill, which may be recognised by a red triangular patch on its south-western slope, in line with Chula Lanka, bearing N. 75° E., leads southward, and Hindelunattu summit in line with Mirissa point, N. 12° W., leads westward, of Prinz Heinrich patch.

Chart 3265.

Talarambee point (*Lat. 5°56′ N., Long. 80°28′ E.*), rocky and slightly elevated, is 4 cables east-south-east of Veragalle point, and close behind it is a white dagoba, the top of which, showing above the trees, is 120 feet high.

Kalcotta rocks, three heads, which are from one foot to 2 feet above water, lie a quarter of a mile south-south-westward of Talarambee point.

Atalahua point, low and not prominent, is $1\frac{1}{10}$ miles eastward of Talarambee point.

Tanana rocks, from 3 to 5 feet above water, are a quarter of a mile south-westward and south-south-eastward of Atalahua point.

Half-way between Kalcotta and Tanana rocks is a rock, awash with the swell, which is $6\frac{1}{2}$ cables westward of Atalahua point.

Moolkalle point, rocky, and contrasting somewhat with its surroundings on account of being covered with low bushes instead of cocoanut trees, lies $1\frac{1}{10}$ miles eastward of Atalahua point; it has a white dagoba just within it.

Korolamba point, scarcely distinguishable as a point, is one mile eastward of Moolkalle point.

Katahella rock, awash, is situated a quarter of a mile south-westward of Korolamba point.

Chula Lanka, a small islet, 73 feet high and covered with cocoanut trees, is 7 cables eastward of Korolamba point, and connected to the shore by a causeway much out of repair. Some rocky heads, two of which are from 7 to 8 feet high, lie 3 cables southward of the islet, with a depth of $1\frac{1}{2}$ fathoms between.

General charts 813, 828, 70.

Chart 3265, Galle to Little Basses. Var. 1° 20′ W.

Nilwala Ganga is entered 4 cables north-eastward of Chula Lanka islet; the opening in the sand through which the river discharges was only about 30 yards wide in February, 1908.

Immediately in front of the river's mouth are several sunken rocks, and close-to are others from 4 to 10 feet above water.

MATARA BAY, formed by the curving coastline between Chula Lanka islet and Dondra head, is mostly foul and entirely open. Very little of the town, situated at the head of the bay, is visible from seaward, but the clock tower is conspicuous between the bearings of N. by W. and N.W. by W. in a favourable light.

A small islet, 41 feet in height and fronting the foreshore, is connected to it by a causeway, on which the sea generally breaks, in front of which is a sunken reef, and nearly a mile to the eastward are some conspicuous red cliffs, the highest 122 feet, while behind them is Brown's hill.

Dangers.—Madumora reef, in the western part of the bay, has less than one fathom water on its northern edge, and a least depth of 1½ fathoms near its southern side, situated $1\frac{3}{10}$ miles south-south-westward of Matara clock tower.

In the eastern part of the bay the water is shoal and the bottom uneven for 8 cables west-south-westward of the western extreme of Dondra head, and between this and Madumora reef the bottom is still very rocky and uneven to Sleet rock, the outermost rocky head, which has 5½ fathoms over it, and is situated nearly 2 miles west-south-westward of Dondra head lighthouse; the least depth in this part of the bay, 3 fathoms, over rocky bottom, is 4 cables northward of Sleet rock.

Town.—Matara town, of considerable size, is next in importance to Galle, in the southern provinces; it is the residence of an Assistant Government Agent, and of several other government officials. In 1901 the population was 11,848.

Communication.—Matara is the terminus of the Coast railway from Colombo, and is a post and telegraph station. Coaches leave Matara daily for Tangalle and Hambantota.

Landing.—Canoes approach the causeway, already mentioned as connecting an islet, by passing over the sunken reef, and either landing on the beach or alongside the causeway, but in ships' boats this is seldom practicable.

DONDRA HEAD (*Lat. 5° 55′ N., Long. 80° 36′ E.*), the southernmost point of Ceylon, is low, with a grove of tall cocoanut trees on it; its western extreme, although connected to the mainland by a rocky ledge, appears as a small islet.

General charts 813, 828, 70.

Chart 3265, Galle to Little Basses. Var. 1° 20′ W.

LIGHT.—Near the eastern extreme of the head is an octagonal tower, 160 feet in height and painted white, which exhibits, at an elevation of 152 feet above high water, a *white flashing* light, which shows *one* flash of *one second* duration *every twenty seconds*, and should be visible in clear weather from a distance of 18 miles.

Beacon.—A pyramidal-shaped beacon, painted white, is situated at an elevation of 45 feet, at 4½ cables north-eastward of Dondra lighthouse.

Landing.—A ship's boat may sometimes be used for landing near the lighthouse, but as sunken reefs exist in that vicinity it may be easier to land on the sandy beach to the northward.

COAST.—From Dondra head to Nilewelli point, a distance of 8 miles, the coast has a general trend to the northward of east, and the low-lying parts between being covered with cocoanut trees it has a somewhat elevated appearance throughout.

Depths off-shore.—Between Dondra head and Nilewelli point, the bank of soundings increases in breadth, and off the latter point the 100-fathoms contour line is 6½ miles off-shore. In this stretch of coast there are no dangers to navigation outside the 10-fathoms contour line, which is generally close to the shore, while the 20-fathoms contour is at its farthest 2½ miles from the coast.

Current.—Between Dondra head and Tangalle point, 13 miles north-eastward, there is often a strong indraught when the westerly current is strong.

Gandura point is rocky, and situated 1¾ miles east-north-east from Dondra head, and between the coast is composed of rocky cliffs, about 100 feet high in one part. A conspicuous banyan tree, 190 feet high, stands 6 cables south-westward of the point, and immediately in front of it and close off the coast is a detached reef of rock, 8 feet above high water at its highest part.

About 4 cables north-north-westward of Gandura point is a remarkable banyan tree, the top of which is 225 feet high.

Anchorage.—There is good anchorage in the western part of Gandura bay, in a depth of 10 fathoms, over sandy bottom, with Gandura point bearing W. by S. ⅜ S., distant 5½ cables, but it is not protected from the swell.

Landing was easily effected here in December, during the survey.

Village.—Gandura village is situated behind the sandy beach, immediately north-north-eastward of the point.

Kotagoda point (*Lat. 5° 57′ N., Long. 80° 38′ E.*), rocky, with boulders, is 1$\frac{4}{10}$ miles east-north-east of Gandura point, with Gandura bay between, the shores of which are moderately high and rocky, and

General charts 813, 828, 70.

fringed with reef, broken for about half a mile by Nuroni cove, with a sandy beach and cocoanut trees.

Gull rocks, the highest 20 feet, extend 1½ cables eastward of Kotagoda point, inside which is a small sandy bight, in front of Kotagoda village.

Etawa reef, 4 cables in length in an east-south-east and opposite direction, with a least depth of 2 fathoms over it, lies about one mile eastward of Kotagoda point.

Clearing mark.—The western extreme of Nuroni cove beach well open of the south-west extreme of Kotagoda point, bearing S. 88° W., leads southward of the reef.

Bambri rocks, 4 feet high, lie nearly half a mile north-eastward of Etawa reef; close off them are sunken patches of rock.

Dikwella bay, half a mile in breadth and inaccessible on account of the reef across its entrance, on which the sea usually breaks, is 3 miles eastward of Kotagoda point. Dikwella village, with a rest house, lies close behind the beach of this bay.

Nilewelli point (*Lat. 5° 57′ N., Long. 80° 43′ E.*), steep-to, rocky, and nearly insulated, has a clump of cocoanut trees 80 feet high on it, and is situated 5 miles eastward of Kotagoda point. It is connected with the main island by a narrow strip of sand, over which the surf washes in a moderate swell, and, seen from the eastward or westward, appears as an islet.

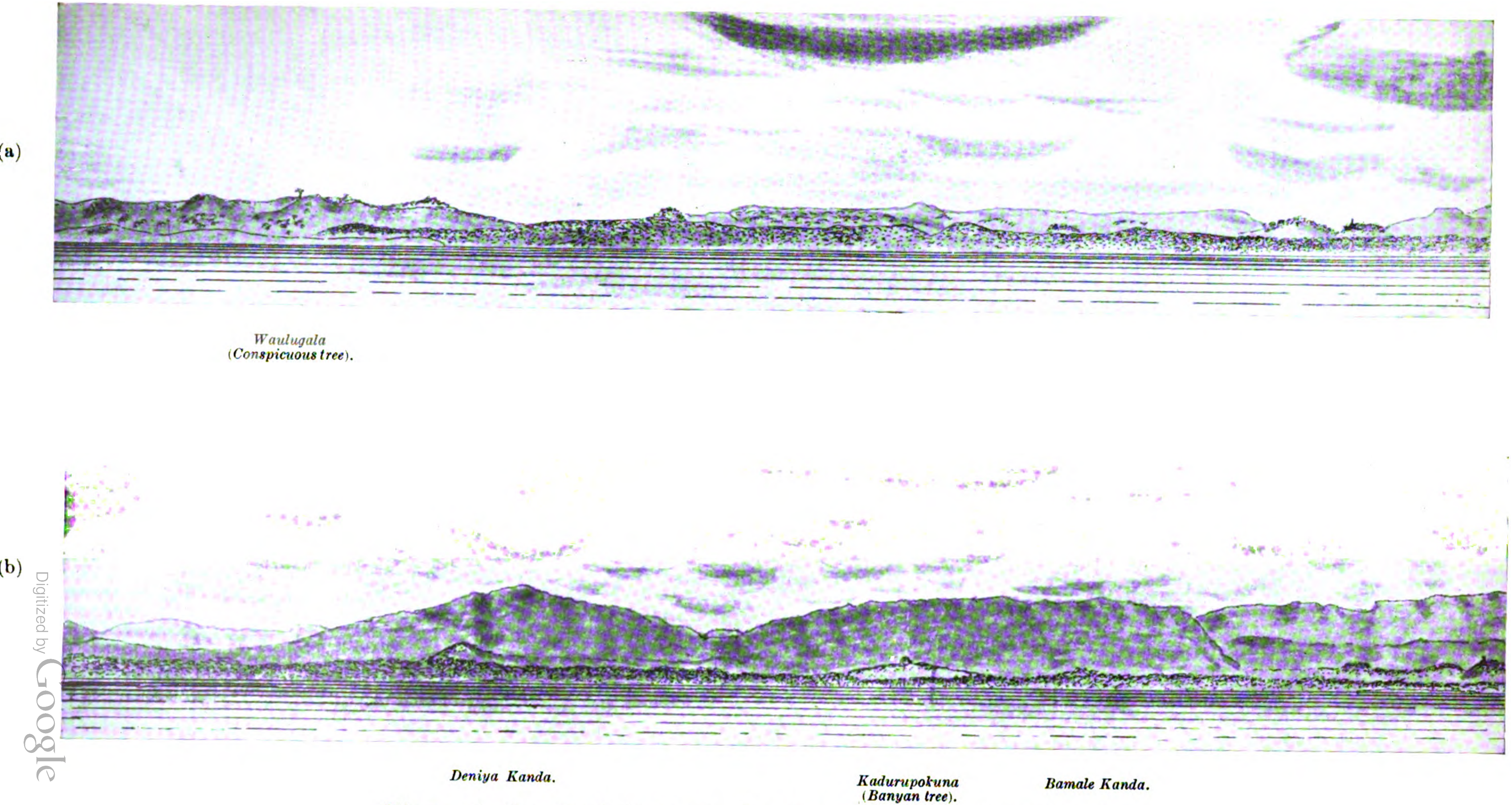
Landing can usually be effected in a ship's boat, immediately to the northward of Nilewelli point, but small patches of sunken reef lying close to the beach have to be avoided.

COAST.—From Nilewelli point the coast trends in a general north-east direction for a distance of 6 miles to Tangalle point, the coastline being a good deal broken by several small bays and indentations; generally it is rocky and of moderate height. (Views *a* and *b*, page 134.)

Depths off-shore.—Between Nilewelli and Tangalle points, the 10-fathoms contour line is close to the shore, with no dangers outside it. The distance between the 10-fathoms and 20-fathoms contour lines increases to the eastward, as does also that between those of 20-fathoms and 100-fathoms, the former being 3½ miles and the latter 11 miles from abreast, or southward, of Tangalle point.

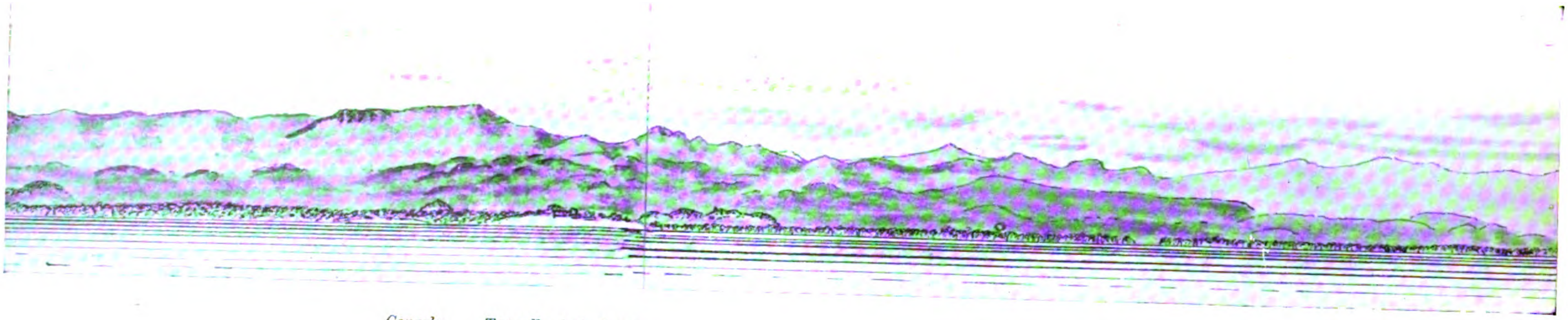
Kolonna point, the southern extreme of a rocky and cliffy peninsula, lies about one mile north-eastward of Nilewelli point, and between is Nilewelli bay, foul in its north-east portion; close off this peninsula are two detached rocks, the western 8 feet, and the southern 4 feet high. A dagoba, painted white, is situated nearly one mile northward of Nilewelli point.

To face page 134.]

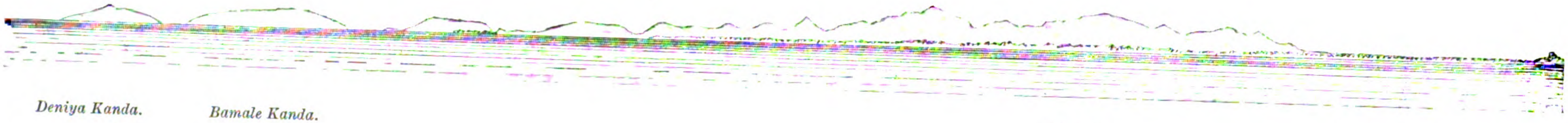


View of the land between Dondra head and Tangalle fort.

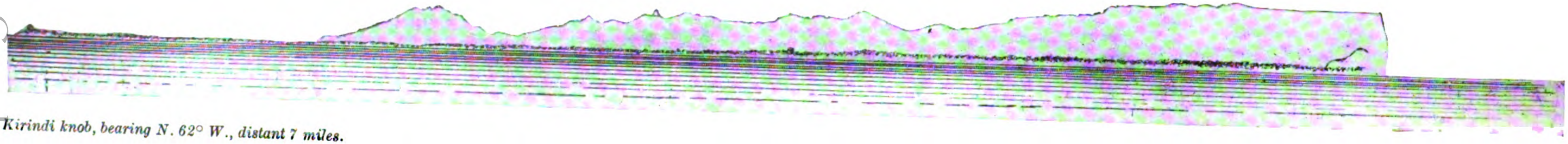
(a)


Gongola.
Tangalle fort, bearing N. 62° W., distant 5 7/16 miles.
Banyan tree.

(b)


Deniya Kanda.
Bamale Kanda.
Gangala.

(c)


Kirindi knob, bearing N. 62° W., distant 7 miles.

View of the land westward and eastward of Kirindi.

Chart 3265, Galle to Little Basses. Var. 1° 20′ W.

Anchorage may be obtained, in depths of from 8 to 10 fathoms, over a sandy bottom, 4 cables north-eastward of Nilewelli point.

Mahawelli point (*Lat. 5° 59′ N., Long. 80° 45′ E.*), the south-eastern extremity of a narrow peninsula of moderate height, nearly bare of trees, and steep and rocky, is situated $1\frac{1}{10}$ miles north-eastward of Kolonna point; between these points is a bight, 4 cables in extent, in the western part of which is Sureya Tree bay, small, sandy, and where small coasting craft anchor in a depth of 5 fathoms, over sandy bottom and close to the beach.

Waulugala, a hill with a bare summit, 555 feet high, and about $3\frac{1}{4}$ miles northward of Nilewelli point, forms a good mark for vessels coasting, but it is not so conspicuous to vessels further off-shore, owing to there being other hills behind it. (View *a*, page 134.)

Unaeria rocks, showing four distinct heads, 6 feet, 5 feet, 3 feet, and one foot above high water, lie from 8 to 9 cables east-north-eastward of Mahawelli point.

Middle rock, nearly awash and always breaking, is $7\frac{1}{2}$ cables east-north-eastward of Mahawelli point.

Mahawelli rock, awash, lies 2 cables eastward of Mahawelli point, with a depth of 7 fathoms between.

Mahawelli bay, immediately northward of Mahawelli point, affords anchorage, in from 5 to 8 fathoms water, over sandy bottom, close northward of Mahawelli rock; it is entered by passing between Mahawelli and Middle rocks, which are half a mile apart.

Tangalle point, $3\frac{6}{10}$ miles north-eastward of Mahawelli point, has on it an old fort, painted white, and conspicuous, which is used as a jail. A rocky ledge extends from the point in a south-east direction. (Views *a* and *b*, page 135.)

COAST.—From Tangalle point the coast having an east-north-east direction, for a distance of $8\frac{3}{4}$ miles to Kalamatta point, is low, sandy, and backed by cocoanut trees.

Depths off-shore.—The bank of soundings extends off-shore for from 12 to 13 miles, between Tangalle and Kalamatta points, the 10-fathoms contour line being fairly parallel to the shore, at distances of from one mile to $1\frac{1}{2}$ miles. The 20-fathoms contour line is more irregular, being from $2\frac{1}{2}$ to 4 miles off shore, but except for vessels making the coast ports, it is unnecessary for them to be inside the 20-fathoms line.

Rekawa point, rocky, barren, and about 50 feet high, is about 4 miles east-north-east of Tangalle point; a reef extends for about a quarter of a mile off all round the point.

General charts 813, 828, 70.

Chart 3265, Galle to Little Basses. Var. 1° 20′ W.

Tangalle bay, between Tangalle and Rekawa points, has a low, sandy coastline, backed by cocoanut trees, and fronted by a considerable amount of rocky reef, just below water. The entrance to the Kunkalle Ganga, usually blocked, is situated 4½ cables north-northwestward of Tangalle point.

Dangers.—Tangalle rock, awash with the swell, and steep-to on its southern and eastern sides, lies one mile eastward of Tangalle point.

Kadul rock, with a depth of 1¾ fathoms over it, is 2 cables northwestward of Tangalle rock.

Ma rock, with 2½ fathoms water over it, lies 4 cables north-eastward of Tangalle rock.

Nakatta rock, on which the depth is 1¼ fathoms, is 4 cables northwestward of Tangalle rock.

Directions.—To enter the bay, pass about half a mile eastward of Tangalle rock, and then steer about N.N.E., until a small white dagoba, situated about half a mile north-westward of the jail, is in line with the cocoanut trees on the south-west bank of the entrance to Kunkalle Ganga, bearing S. 86° W., and, steering on this line, anchor in from 5 to 6 fathoms water, with Tangalle rock bearing between S. by E. and S.S.E. ⅜ E. The dagoba is very difficult to distinguish with the sun in the west.

Town.—The town of Tangalle is behind the point of that name, and on the rising ground of the latter are the residences of Government officials. In 1901 the town had a population of 2,333.

Communication.—There is a post and telegraph office, and a coach daily to Matara and Hambantota.

Landing.—The best landing place is 1¼ cables southward of the mouth of Kunkalle Ganga.

KALAMATTA POINT (*Lat. 6° 4′ N., Long. 80° 56′ E.*), moderately high and rocky, is 4¾ miles east-north-eastward of Rekawa point, the coast between being a long line of cocoanut trees; midway between is Kahandawa point, slightly projecting.

Kalamatta point terminates in a large boulder, from which a chain of rocky islets extends in a south-easterly direction, and for more than a mile eastward of Kahandawa point a sunken reef extends for some distance, being fully half a mile from the shore when one mile south-westward of Kalamatta point.

Kahandawa rocks, 2 feet high, lie three-quarters of a mile south-westward of Kahandawa point, the inner rock being on the edge of the shore reef, and the outer 7 cables south-south-west of the point.

Chart 3265, Galle to Little Basses. Var. 1° 20′ W.

A rocky head, with a depth of 4¾ fathoms over it, is situated just inside the 10-fathoms contour line, 3¼ cables southward of the outer rock, and between the rocks and Rekawa point the depths are very uneven, over a rocky bottom.

Kalamatta rock, of which a small pinnacle just shows above water, lies 3¾ cables eastward of Kalamatta point.

Watta rock, a small, circular, barren islet, 24 feet high, owing to the light colour of its upper part, stands out somewhat conspicuously from the chain of rocks extending from Kalamatta point, of which it is the south-east extremity.

Within a distance of half a mile of Watta rock, and between an east, through south, to south-west direction, are several rocky patches on which the depths are from 4 to 5 fathoms, and 3 cables to the south-eastward of Watta rock is a sunken rock, on which the sea generally breaks.

Anchorage in depths of from 5 to 7 fathoms, over sand and rock bottom, may be obtained at from 3 to 5 cables east-north-east of Watta rock.

COAST.—From Kalamatta point the coast trends slightly northward of east for a distance of 12 miles to Hambantota point, and is mostly low, barren, sandy, and interrupted by only two or three cliffy points.

Depths off-shore.—On the above-mentioned stretch of coast, the few actual dangers to navigation are bounded by the 10-fathoms contour line, which should not be approached too closely. The 20-fathoms contour line lies from 3 to 4 miles off-shore, and the whole bank of soundings gradually widens to the eastward, the 100-fathoms contour being 14 miles to the southward of Hambantota point.

Ulandhe point (*Lat. 6° 5′ N., Long. 80° 58′ E.*), 2½ miles east-north-eastward of Kalamatta point, is steep, cliffy, and red coloured; the summit, immediately over the point, is 60 feet high, and between the two points is a sandy beach, with low scrub, and a lagoon close behind it.

For a distance of over half a mile off this beach the depths are very uneven, over a rocky bottom, and Swell rock, situated off the shore nearly one mile south-westward of Ulandhe point, is a rocky head with 3¾ fathoms water over it, which breaks in a moderate swell.

Rattan point, 7½ cables east-north-east of Ulandhe point, is similar to it in description and colour; between are two sandy bights, separated by a sloping point, with a rocky ledge extending from it.

General charts 813, 828, 70.

Chart 3265, Galle to Little Basses. Var. 1° 20′ W.

Rocks extend for nearly 4 cables off the coast between these points, one, 15 feet high, and black, being about one cable southward of Rattan point.

Godawaya point, 50 feet high, and rocky, has a white dagoba within, and a reef awash immediately eastward of it, and between it and Rattan point, a distance of 3¾ miles in an easterly direction, is a slightly-curving sandy beach, for the first mile backed by cocoanut trees, and for the remainder consisting of low hills and scrub.

About 1¾ miles eastward of Rattan point is the entrance to Walawe Ganga, usually a very small opening in the sandy beach.

Ibha rock, 7½ cables south-south-eastward of Godawaya point, has less than one fathom water over it, and is steep-to; the sea does not always break on this rock.

Nehindi rock, awash and steep-to, lies 9 cables east-south-east from Godawaya point.

CAUTION.—These two rocks constitute a danger to the westward of Hambantota, for vessels entering or leaving that port, but there should be no difficulty in fixing a vessel's position by bearings of Godawaya dagoba and Hambantota point.

Veralawinha point is 2¾ miles eastward of Godawaya point, and between and to the eastward of Hambantota the coast is one long stretch of sand, on which a heavy surf breaks.

A little over one mile eastward of Godawaya point the sandy beach advances slightly, and off this projection the reef is awash for a distance of nearly 2 cables from the shore.

Plan of Hambantota on 3730.

HAMBANTOTA POINT, nearly 5 miles eastward of Godawaya point, is a rocky promontory with red sandy soil, from which a bare rocky ledge extends three-quarters of a cable to the south-eastward, its highest part, at the extreme, being 13 feet above high water. A large white martello tower and some houses are situated on the point.

Light (*Lat. 6° 7′ N., Long. 81° 8′ E.*).—A *red fixed* light is exhibited, at an elevation of 60 feet above high water, from a lantern on a staff on Hambantota point, but, being unwatched, it is unreliable.

Pier.—A pier extends from the shore in a north-north-east direction from the northern side of the point.

Buoy.—A can buoy, painted red, and moored in a depth of 4 fathoms, 2 cables east-north-east of the pierhead, is only used for local purposes, and is liable to go adrift.

General charts 3265, 813, 828, 70.

Plan of Hambantota on 3730. Var. 1° 20′ W.

Anchorage.—There is seldom much protection from the swell off Hambantota, and though the wind may be from the N.W. the swell sets fairly on to the coast, so that a vessel at anchor has then the swell on the port bow.

The best berth is in depths of from 5 to 6 fathoms, over a sandy bottom, and 3¾ cables north-eastward of the extreme of the rocks at Hambantota point; during the North-east monsoon it is better to anchor farther to the south-eastward.

Tides.—It is high water, full and change, in Hambantota at 2h. 37m.; springs rise about 2¼ feet.

Town.—Hambantota is the residence of an Assistant Government Agent, and it is here that the salt-collecting industry for the southern province is controlled under Government supervision. The Residency is situated near the martello tower, and in that vicinity are several other buildings, including the rest house. In 1901 it had a population of 2,483.

The native town is situated behind the sandy beach to the north-eastward of the point.

Communication.—The Ceylon Steam Navigation Company's steamers call twice every month from, and returning to, Colombo. A post and telegraph office is situated in the native town, and there is a mail and passenger coast service to Tangalle and Matara.

Landing.—The sea often breaks outside the pier, and at such times landing can be effected on the beach immediately northward of the pier.

Winds.—South-westerly and westerly winds prevail at Hambantota from April to October, except in August, when north-westerly winds are common.

North-easterly winds blow in December and January; in February south-westerly winds, and in March south-easterly winds, prevail, but winds from other directions are frequent. Calms are frequent in November.

Current.—The currents, although weak, generally set parallel to the coast, and thus, being at right angles to the swell, prevent a vessel from lying head on to it.

Between Weligama and Hambantota the currents were found during the survey to be weak, and although sometimes variable in direction, generally set with the prevailing wind; the greatest velocity registered was slightly less than one knot and the average rate half a knot.

Pitawatan point (*Lat. 6° 8′ N., Long. 81° 9′ E.*), sandy and covered with scrub, terminates in a low rocky ledge, and is situated

Plan of Hambantota on 3730. Var. 1° 20′ W.

1¼ miles north-eastward of Hambantota point, and is the eastern extreme of the small bay formed between.

Chart 3265.

COAST.—Between Hambantota and Little Basses the coast is sandy and barren, with points from 50 to 150 feet high; between the points and behind the coast the land is low, with here and there hills which usually rise abruptly, and in clear weather the mountain district of the island will be seen in the background.

The most conspicuous elevations, situated from 2 to 8 miles inland, are Kataragama peak, 1,395 feet high, which is the summit of a range sharp-topped when viewed from the south-westward, but flat-topped as seen from the south-eastward or eastward. (View *a*, page 140.)

Rocky Knob, 322 feet high, is a remarkable pillar of rock, amongst a rocky ridge. (View *b*, page 140.)

Akasachetiya (Elephant hill), 530 feet high, presents a most conspicuous mass of bare rock. (View *c*, page 140.)

Mayagala, 725 feet high, has a remarkable cone-shaped appearance when viewed from the eastward.

Dematagala (*Lat. 6° 30′ N., Long. 81° 32′ E.*) has two summits, the higher 1,004 feet, and Mandagala, the summit of which resembles a square tower, is 523 feet high.

Anchorage.—Open anchorage over a bottom of sand and rock may be obtained off almost any part of this coast, but no bights afford shelter during either monsoon, although, in the South-west monsoon, if the wind is well to the eastward, the sea is less disturbed off the eastern part of this coast. Close to the beach, on which the surf breaks heavily, there are several rocky patches both sunken and showing above water.

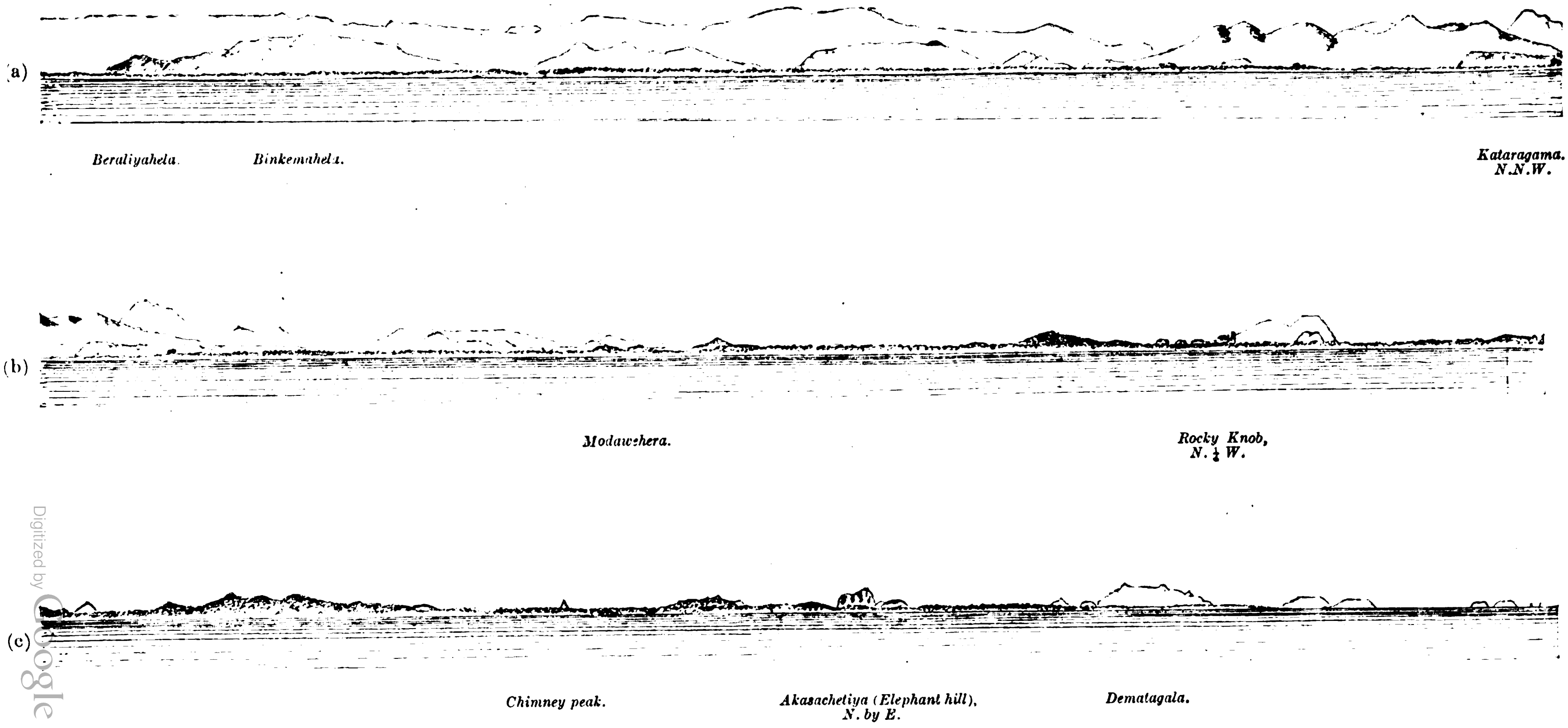
General directions.—Proceeding along this coast, the route is outside both Great and Little Basses reefs, passing at a distance of about 2 miles eastward of them, but care is necessary when off the eastern end of Little Basses, where the 10-fathoms contour line extends to the east-north-eastward of the lighthouse for a distance of 3 miles, and should not be crossed.

Steering a N.E. ¼ E. course, and having Little Basses lighthouse 2 miles distant when abeam, that course should be continued for another 3 miles before altering to the northward, in order to avoid passing inside the 10-fathoms contour line.

Depths off-shore.—As has been already mentioned, the 100-fathoms contour line passes at a distance of 3 miles from the coast at Dondra head, and from this it recedes from the coast in a E. by N. direction for about 44 miles, where it is 18 miles distant from the land.

General charts 813, 828, 70.

To face page 140.]



View of the land between Kirindi and Patanagala point.

Chart 3265, Galle to Little Basses. Var. 1° 5′ W.

From this latter position the 100-fathoms contour line, bending sharply to the north-eastward, gradually closes the coast for about 33 miles till in lat. 6° 15′ N., it is distant only 11 miles, and there, turning abruptly to the northward, it passes within one mile of Little Basses reef, afterwards gradually again receding from the land.

Currents.—Observations made during the survey of this part of the coast, in H.M. Surveying Vessel *Sealark*, between October, 1908, and May, 1909, tend to show that the currents in this locality are most strongly influenced by the prevailing winds.

During October and the early part of November, north-east and south-west currents, with a maximum rate of one knot, were about equally experienced, and from the latter part of November to March, they set with little variation between west-south-west and south-south-west, the maximum rate being 2 knots.

As an instance of the influence of the wind on the currents it may be mentioned that, after a cyclonic storm which occurred in the Bay of Bengal, in December, the north-east wind was replaced for a time by a light wind from the south-westward, and the direction of the current was between north-north-east and east-north-east, until the change of wind ceased, when it resumed its old direction.

COAST.—From Hambantota to Dorava point, a distance of about 13 miles the coast trends in an east-north-east direction, and is sandy and barren. From Pitawatan point to Gurugudu point is a sandy beach, with considerable sunken reef extending to a cable outside it.

Gurugudu point (*Lat. 6° 9′ N., Long. 81° 10′ E.*), 3 miles east-north-eastward of Hambantota tower, is rounded and not easily distinguishable as a point; a few detached rocks lie off it close to the coast.

Patiraja point, 3½ miles further in the same direction, is of a slightly reddish colour, and terminates in a rocky ledge 2 feet high. The coast between Gurugudu and Patiraja points is a gradually-curving sandy beach, with a bare sand hill, slightly higher than the elevated ground of the latter point, about 3 cables eastward of it; westward of the same point is a small bight, the shore being covered with scrub.

Urani point.—From the small bight to the northward of Patiraja point the sandy beach is nearly straight to Urani point, which, situated 3¼ miles east-north-eastward of Patiraja point, may be recognised by a small grove of cocoanut trees lying behind it, as such trees are of rare occurrence in this locality. Bundala village is situated near the grove of cocoanut trees.

General charts 813, 828, 70.

Chart 3265, Galle to Little Basses. Var. 1° 5′ W.

Dorava point (*Lat. 6° 12′ N., Long. 81° 20′ E.*), bare, rocky, and 58 feet high, is situated 3¼ miles, east-north-eastward of Urani point, the coast between being only slightly indented; the point may be easily recognised.

Lansiya rock, 21 feet high, and situated half a mile south-south-westward of Dorava point, has foul ground extending westward of it for a distance of one mile, and to 5½ cables from the shore.

Dorava rock, a small, rocky head, with a least depth of 3 fathoms over it, lies 7 cables from, and is the outermost danger off, Dorava point.

Depths off-shore.—On the bank of soundings inside the 100-fathoms contour line, which has its greatest breadth off the coast between Hambantota and Dorava points, the depths are from 30 to 40 fathoms, and the 5-fathoms line is only from 2 to 5 cables from the coast, with no dangers to navigation outside it.

Between one mile and 5 miles off shore, the depths are from 10 to 20 fathoms, but the water deepens to 30 fathoms another mile farther out. In the area from about 6 miles off the coast to about one mile inside the 100-fathoms contour line, a general breadth of from 8 to 10 miles, the depths are from 30 to 40 fathoms.

COAST.—The coast from Dorava point trends in a north-easterly direction for a distance of about 11½ miles to Butawa point, with sand-hills and rocky formations of moderate height close behind.

Kirindi point, of rocky formation is situated nearly 1½ miles north-eastward of Dorava point; a rocky ledge extends in an east-south-east direction, and outside it is Korha rock, 2 feet high and 2¾ cables from the point.

Kirindi Knob, a group of boulders 123 feet high, is 2¼ cables westward of the point; it may be seen from the westward over the land inside Dorava point, appearing as a small conical summit. (View *c*, page 135.)

Dangers.—A rock, with a least depth of 1¼ fathoms over it, lies 2½ cables east-north-east, and a reef, about 2 cables in diameter, on which the sea always breaks, is situated 4½ cables north-eastward of the point; between the rock and the reef there is a channel about a cable in breadth, with depths of from 3 to 5 fathoms.

Anchorage.—Only the same open anchorage as on other parts of this coast can be obtained, but a vessel wishing to communicate with Kirindi village will find better anchorage to the southward of the point, in from 8 to 10 fathoms water, than to the eastward, where there appears to be a considerable amount of rock. Approaching the anchorage, Kataragama peak should be kept well open eastward of Kirindi Knob, bearing about N. ¼ E., which only just clears Dorava rock to the eastward.

Kirindi village, close to the beach, northward of the point, is a Government salt collecting station, and native sailing craft anchor close outside it.

Landing is generally difficult.

Tides.—It is high water, full and change, at Kirindi at 3h. 30m.; springs rise 2 feet.

Palutupana point (*Lat. 6° 14′ N., Long. 81° 23′ E.*), the extremity of a sandy rise is 2 miles north-eastward of Kirindi point, with a slight sandy bay between; sunken patches of rock extend a cable from the coast.

Mutugala point, somewhat similar to Palutupana point, from which it is distant 2 miles in a north-east direction, and with a sandy coast between, has two bushy summits 1⅓ miles north-west and 6 cables north from it, which are 196 and 129 feet high, respectively. The latter will be referred to hereafter as a leading mark for passing westward of Little Basses ridge.

The point is fronted by patches of rocky reef, and at a distance of a cable off it is a rock 6 feet high; shoal patches extend to the southward of the point, the outermost, with a depth of 3¾ fathoms, being half a mile distant from it.

Amaduwa point, low and rocky at its extreme, is situated 2¼ miles north-eastward of Mutugala point, the rocky and sandy coast between being slightly indented; a rocky reef, the outer part of which is awash, extends 3 cables off-shore about midway between the points.

Rocks.—Two rocks, 14 and 18 feet high, lie southward of the point, the outer and higher being 1¼ cables distant from it.

A rocky head, on which the depth is 4 fathoms, lies half a mile eastward of Amaduwa point.

Landing may be effected in a small bight immediately northward of the point, and this is the first convenient place eastward of Hambantota.

Butawa point, rounded and moderately high, is 3¾ miles east-north-east of Amaduwa point: the sandy coast between, forming several slight bights, has several small rocks from one cable to 2 cables off it, the higher of two, 12 and 15 feet above water and close together, being 2¼ cables from the shore.

Chart 3265, Galle to Little Basses. Var. 1° 0′ W.

Danger.—Shoal water extends from about $1\frac{1}{2}$ miles north-eastward of Amaduwa point for a distance of $4\frac{1}{2}$ cables from the coast, the least depth of $2\frac{3}{4}$ fathoms being $1\frac{6}{10}$ miles from the point.

Butawa rock, 6 feet high, and steep-to on its south-west and south-east sides, lies $1\frac{3}{4}$ cables south-eastward of Butawa point.

GREAT BASSES REEF, about $6\frac{1}{2}$ miles south-eastward of Mutugala point, is narrow, about three-quarters of a mile in length in an east-north-east and opposite direction, and has some portions about a quarter of a mile in length above water; the eastern and highest part of the reef, on which stands the lighthouse, is 6 feet above water.

The 10-fathoms contour line is within 4 cables of the north and south sides, but it is distant nearly 2 miles from the east-north-east, and nearly 12 miles from the west-south-west ends of the reef, and in either of these directions a vessel should not approach the lighthouse within a distance of 2 miles.

LIGHT (*Lat. 6° 11′ N., Long. 81° 29′ E.*).—On the north-east and highest part of the Great Basses reef is a granite tower, 125 feet in height, painted white, and having a conically-shaped top; the tower is surrounded by two galleries, one 30 feet above the base, the other close under the lantern. From the tower is exhibited, at an elevation of 110 feet above high water, a *red flashing* light, showing a flash of *five seconds* duration *every forty-five seconds*, which should be visible in clear weather from a distance of 16 miles.

Great Basses ridge, rocky, narrow, and steep-to, extends within the 10-fathoms contour line from each end of Great Basses reef for a distance of $1\frac{9}{10}$ miles east-north-east, and $11\frac{3}{4}$ miles west-south-west, from the lighthouse; except within 2 miles of the lighthouse, no depth of less than $6\frac{1}{2}$ fathoms has been found on it.

Ship rock, with a least depth of 5 fathoms over it, and situated $5\frac{6}{10}$ miles east-north-eastward of Great Basses lighthouse, is the middle and shoalest part of a narrow rocky patch, about one mile in extent in an east and opposite direction.

About half a mile south-eastward and east-south-eastward of Ship rock, and near the edge of the 20-fathoms contour line, are small patches with depths of 9 and 10 fathoms, and from 12 to 13 fathoms between them and Ship rock.

Depths off-shore.—With the exception of the few shoal spots mentioned as existing between Dorava and Butawa points, the 5-fathoms contour line is close to the coast, from which latter the 10-fathoms contour line is distant about $1\frac{1}{4}$ miles.

General charts 813, 828, 70.

Chart 3265, Galle to Little Basses. Var. 1° 0′ W.

The 20-fathoms contour line passes close outside the Great Basses ridge and Ship rock and between these latter and the 10-fathoms contour are extensive banks, with depths of from 6 to 10 fathoms, over a sandy bottom, which generally extend from 2 to 3 miles outside the 10-fathoms contour line.

The 30-fathoms contour line is only about a mile outside that of 20 fathoms and between the former and the 100-fathoms contour are depths of from 30 to 40 fathoms.

COAST.—From Butawa point the coast trends in a north-east direction for a distance of 17½ miles to Illukatiya point, and between it is sandy and forms several slight bays. The western extreme of Little Basses ridge is 9 cables from Butawa point.

Chiddle rock, a small rocky head, with a least depth of 5¼ fathoms over it, and from 8 to 9 fathoms around, lies 6 cables south-eastward of Butawa point.

Patanagala point (*Lat. 6°20′ N., Long. 81°30′ E.*), resembling a haycock, and about 2 miles north-north-eastward of Butawa point, is the extremity of a bare rocky hill, 137 feet high; the rocky and sandy coast between has shoal and uneven soundings extending to a distance of 7 cables.

The outermost off-lying danger is a rock, with a least depth of 3¾ fathoms over it, lying 7¾ cables south-south-eastward of Patanagala point.

Transit hill, a bare, rocky elevation having two summits nearly equal in height, and joined by a ridge of only slightly less elevation, is situated 3½ cables west-north-west of Patanagala point; the western summit is 163 feet high. (View *d*, page 148.)

Landing.—Some rocky ledges form a slight breakwater to the northward of Patanagala point, and between them and the coast landing is sometimes practicable.

Elephant rock, 2 feet high, is 3¾ cables east-south-east from Patanagala point.

Pillinawa point.—A sandhill, 108 feet high, situated 4¼ miles north-eastward of Patanagala point, terminates in two rocky points three-quarters of a mile apart, the north-eastern of which is Pillinawa point; being surrounded by low land, it appears from a distance as an island. Between Pillinawa and Patanagala points the coast is closely backed by sandhills, and forms a bay about half a mile in extent, off the beach of which are patches of reef on which the sea breaks heavily.

Menik Ganga, also known as Yala river, is about midway between the above-mentioned points.

General charts 813, 828, 70.

Two rocky heads, which show one foot above water, lie off the western of the two rocky points, and shoal water extends for a distance of half a mile from the coast and 1½ miles south-westward of Pillinawa point.

Caution.—When 2 miles westward of Pillinawa point, the coast should not be approached within the distance of three-quarters of a mile.

COAST.—From about a mile eastward of Pillinawa point, to Uda point, a distance of about 3¼ miles, the coast is closely backed by sandhills, of moderate height, partly covered with scrub, and rocks and sunken patches extend for a distance of about one cable from the shore; outside this the water gradually and regularly deepens to near the edge of Little Basses ridge.

Landing.—During the survey, in the months of March and April, landing was found practicable in a small bight to the northward of Uda point.

Pahala point (*Lat. 6° 27′ N., Long. 81° 40′ E.*), 3¼ miles north-eastward of Uda point, is the extremity of a sandhill slope, and for about a mile on either side of it rocky ledges and sunken patches extend for a distance of 1½ cables from the shore.

Illukatiya point, ill-defined, is nearly 4 miles north-eastward of Pahala point, and between them the coast is principally composed of sandhills partly covered with scrub.

Kumbukkan Aru, the mouth of which is situated immediately northward of the point, forms the eastern boundary of the southern province, and the area enclosed between this river and the Menik Ganga, and from the coast to the northern boundary of the southern province, is preserved as a game sanctuary.

A considerable amount of sunken reef extends for about 2 cables from the shore at the mouth of the Kumbukkan Aru.

Lewin rock, with a least depth of 3 fathoms, amongst depths of 6 fathoms, lies fully a mile from the coast, and 4$\frac{2}{10}$ miles north-north-west of Little Basses lighthouse.

Dædalus rock, apparently a boulder, with a least depth of 1¾ fathoms over it, resting on a narrow rocky ridge, from 4 to 5 cables in length in a north and south direction, on which the depths are from 3 to 5 fathoms, is situated 6½ cables south-south-eastward of Lewin rock.

LITTLE BASSES REEF, about 1½ cables in length in a north-east and opposite direction, and half a cable in breadth, is about 2 feet above high water, and lies about 5½ miles south-eastward of Pahala point. To the southward and south-westward the approach is steep, as, in the latter direction, the 100-fathoms contour line is distant 9½ cables, and the 10-fathoms contour 6¼ cables; with one exception, hereinafter mentioned, near approach to the reef must be avoided on all bearings.

Similarly to Great Basses reef, there is a long extension to this reef under water, but in this case the depths on it are less, and in many parts cause absolute danger to navigation, so that it is not advisable for any vessel, except of light draught, to attempt to cross any part of the extension of this reef.

LIGHT (*Lat. 6° 24′ N., Long. 81° 44′ E.*).—From a granite tower, 125 feet in height, and painted white, standing on Little Basses reef, is exhibited, at an elevation of 110 feet above high water, a *white group flashing* light, with a period of system of *one minute*, showing thus:—flash, *five seconds;* eclipse, *ten seconds;* flash, *five seconds;* eclipse, *forty seconds*, which should be visible, in clear weather, from a distance of 16 miles. The light tower has a domed roof, and is surrounded by two galleries, 12 feet apart, the upper being close under the lantern.

Little Basses ridge extends about 15½ miles in a west-north-west and 1½ miles in an east-north-east direction from the lighthouse; the depths on the ridge are not more than 5 fathoms, and it is in most parts very narrow and also steep.

The western end of the ridge is situated 9 cables south-eastward of Butawa point, and along the ridge to the eastward for a distance of 3¾ miles are many rocky heads with depths of from 1½ to 3 fathoms over them, and on which the sea often breaks; but there are periods when no breakers occur. Further east the patches are less frequent, with depths of from 3 to 4 fathoms to about 1½ miles from the lighthouse, where the ridge broadens to the reef.

Eastward of the reef the ridge, again quite narrow, extends for 1½ miles from the lighthouse, beyond which the depths are irregular and overfalls occur; vessels should keep outside a depth of 10 fathoms, the outermost patch of that depth being 3 miles east-north-eastward from the lighthouse.

The sea may break on any part of Little Basses ridge with a moderate swell, where the depths are not more than 3 fathoms, although it is probable it may break in a greater depth, and a light-draught vessel crossing the ridge for any purpose should do so between from 2 to 6 miles south-westward of the lighthouse, approaching it only between the bearings of S.E. and E. by S. ¾ S., if wishing to communicate with it.

Chart 3265, Galle to Little Basses. Var. 1° 0′ W.

An area of shoal ground exists to the north-north-westward of the lighthouse, and no vessel should approach the reef with the lighthouse bearing between S.S.E. ¾ E. and S. ½ W. within a distance of 1½ miles, as inside this distance the soundings are irregular, and the depths only 3 fathoms in places.

Atlas rock (*Lat. 6° 25′ N., Long. 81° 45′ E.*), with 3 fathoms water over it, lies nearly 1½ miles north-eastward of Little Basses lighthouse.

Bank.—To the southward of the western half of the Little Basses ridge is a very extensive bank, with depths of from 5½ to 10 fathoms, over a sandy bottom, and depths of from 10 to 15 fathoms between it and the ridge. The least water found on any part of this bank was 5½ fathoms, situated 3¾ miles S.E. by S. from Pillinawa point.

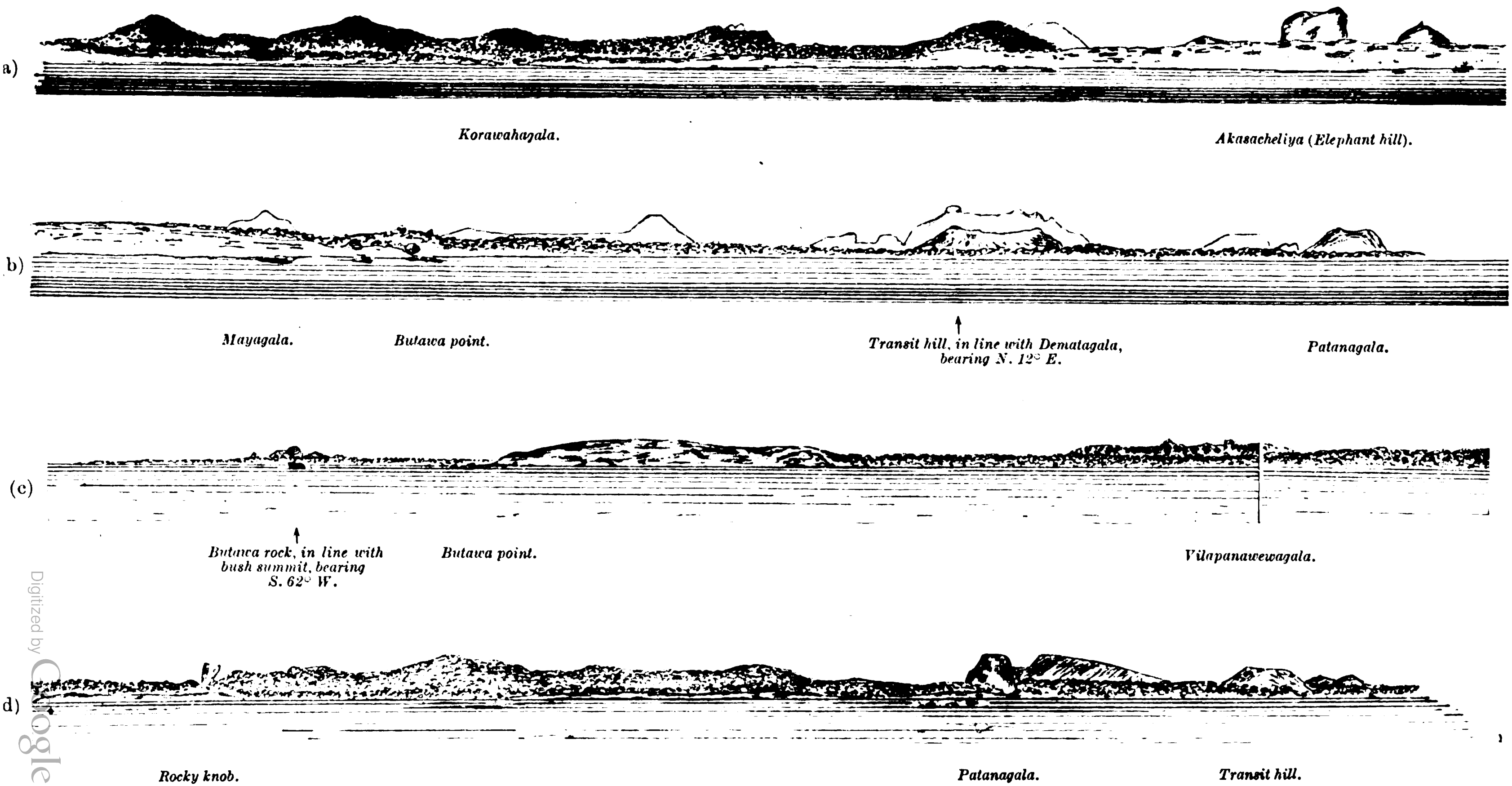
Directions.—Inner passage.—Although as already stated (page 140) the general route for vessels is outside the Great and Little Basses reefs, in clear weather, with the natural landmarks visible, a light-draught vessel would probably find less sea by passing between the main island and these reefs, in which case the following directions will be found useful:—

The objects useful for fixing a vessel's position, which, with the aid of the chart and views, will be easily recognised, are:—A summit, 293 feet high, immediately north-westward of Kongala; Mandagala; Dematagala; Mayagala; Akasachetiya (Elephant hill); Patanagala Rocky knob; and the lighthouses on Great and Little Basses. (Views *a* and *d*, page 148, and *a* and *b*, page 150.)

Approaching from the eastward, steer S.W. ⅝ W. to pass 8 cables to the south-eastward of Dædalus rock, and when the summit of Mandagala is just open westward of Pahala point, bearing N. 29° W., and the latter distant 2$\frac{4}{10}$ miles, alter course to S.W. by W. ½ W., passing 1¾ miles and 8 cables respectively from Uda and Pillinawa points, and when past the latter Butawa rock (6 feet high) should be in line with the bush summit, 129 feet high (page 143), bearing S. 62° W., if the vessel is on the proper track. (View *c*, page 148.)

Steer with this as a mark until Patanagala summit is in line with Dematagala summit, bearing N. 10° E., when the bush summit should be gradually opened to the southward of Butawa rock, and after running half a mile alter course to S. by W. to pass Butawa rock and the western extreme of Little Basses ridge, which are 7 cables apart.

When steering the S. by W. course the western summit of Transit hill (page 145) should be in line with the summit of Dematagala, 'o face page 148.]


a)
Korawahagala.
Akasacheliya (Elephant hill).
b)
Mayagala.
Butawa point.
Transit hill, in line with Dematagala, bearing N. 12° E.
Patanagala.
(c)
Butawa rock, in line with bush summit, bearing S. 62° W.
Butawa point.
Vilapanawewagala.
d)
Rocky knob.
Patanagala.
Transit hill.

Leading marks for the channel inside the Basses.

bearing N. 12° E., as a stern mark, which line leads slightly to the westward of Chiddle rock, and when 3 miles from Transit hill on this bearing a S.W. ⅞ W. course may be shaped to pass half a mile outside the dangers extending from Dorava point, and 1¼ miles from the point itself. (View *b*, page 148.)

Winds and currents.—The following table* shows the winds and currents prevalent in the vicinity of Little Basses reef:—

Month.	Wind.	Current.		REMARKS.
		Direction.	Hourly rate, miles.	
January	Strong, steady north-east monsoon.	S.S.W.	2 to 3½	Sea cross and rough. Ships bound to N.E. should avoid S.E. coast of Ceylon this month.
February	North-east monsoon, light towards end of month.	S.S.W.	2, sometimes slackens.	At end of February land and sea breezes commence, and there are regular tides at springs.
March	Land and sea breezes.	Generally S.S.W., but variable at times.	Weak	Passage up and down coast easy this month, which is fine.
April	North-east and south-west.	Variable, occasionally S.W.	Weak. If S.W. strong.	Gloomy weather; occasional showers, thunder and lightning. Intense blackness over the land.
May	South-west monsoon sets in between 1st and 20th.	N.E.	1 to 3	Much rain, thunder, and lightning, until south-west monsoon sets in, then no rain till October.
June July August Sept.	South-west monsoon begins at 10 a.m., increases to a gale by noon, so continues until 4 p.m. and decreases at sunset. If it continues after sunset, moderates at about 10 p.m.; strong breeze only at night.	N.N.E.†	1 to 3	Towards end of September regular south-west monsoon ceases on south coast of Ceylon, wind becomes variable, land and sea breezes setting in, with intervening calm.
October	Regular land and sea breezes.	N.N.E. changing about middle of month to S.S.W.	5.	
November	Land and sea breezes in early part; north-east monsoon sets in strong towards end of month.	S.S.W.	4 to 5	Rainy, with thunder and lightning.
December	North-east monsoon	S.S.W.	5	Current attains its greatest strength. In December most difficult to proceed northward along the south-east coast of Ceylon.

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* From a report of the master of the light-vessel formerly at Little Basses, April, 1869.

† During the south-west monsoon the current after running north-eastward at the rate of 3 miles for a period of about ten days, suddenly slackens, and runs south-westward at the rate of 2 to 3½ miles for sometimes one day, at others a week.

Chart 813, Ceylon, south coast. Var. 1° 0′ W.

COAST.—Between Illukatiya point (page 146) and Komuriya the coast trends in a general north-north-east direction for a distance of 30 miles, and is broken only by a few slight indentations; it is nearly all sand backed by jungle, which extends over low flat wooded ground, joined by isolated hills, which are at a considerable distance inland.

Mandagala, 5 miles west-north-west from Illukatiya point, is 513 feet high, and conspicuous, its summit having a precipice of light-coloured rock facing northward. From the south-eastward the top of the precipice appears clear of the summit of the hill. From the vicinity of Great Basses the hill is not well seen, and it is sometimes obscured by haze, especially in the South-west monsoon.

Chimney hill (Pagoda peak) (*Lat. 6° 39′ N., Long. 81° 30′ E.*), about 11 miles north-westward of Mandagala, is remarkable, appearing as a truncated cone surmounted by a vertical rock, resembling a chimney. Isolated and conspicuous, this hill may be seen outside a distance of about 4 miles off the coast, when it shows above the low intervening land. (Views *b* and *c*, page 150.)

Currents.—Between Basses rock and Trincomalí, from March to August, the direction of the in-shore currents often changes from north to south, and back again, without any apparent reason, but the direction is always parallel to the shore. The northerly and southerly streams run side by side, more than one stream in each direction having been found between 3 and 10 miles off the land.

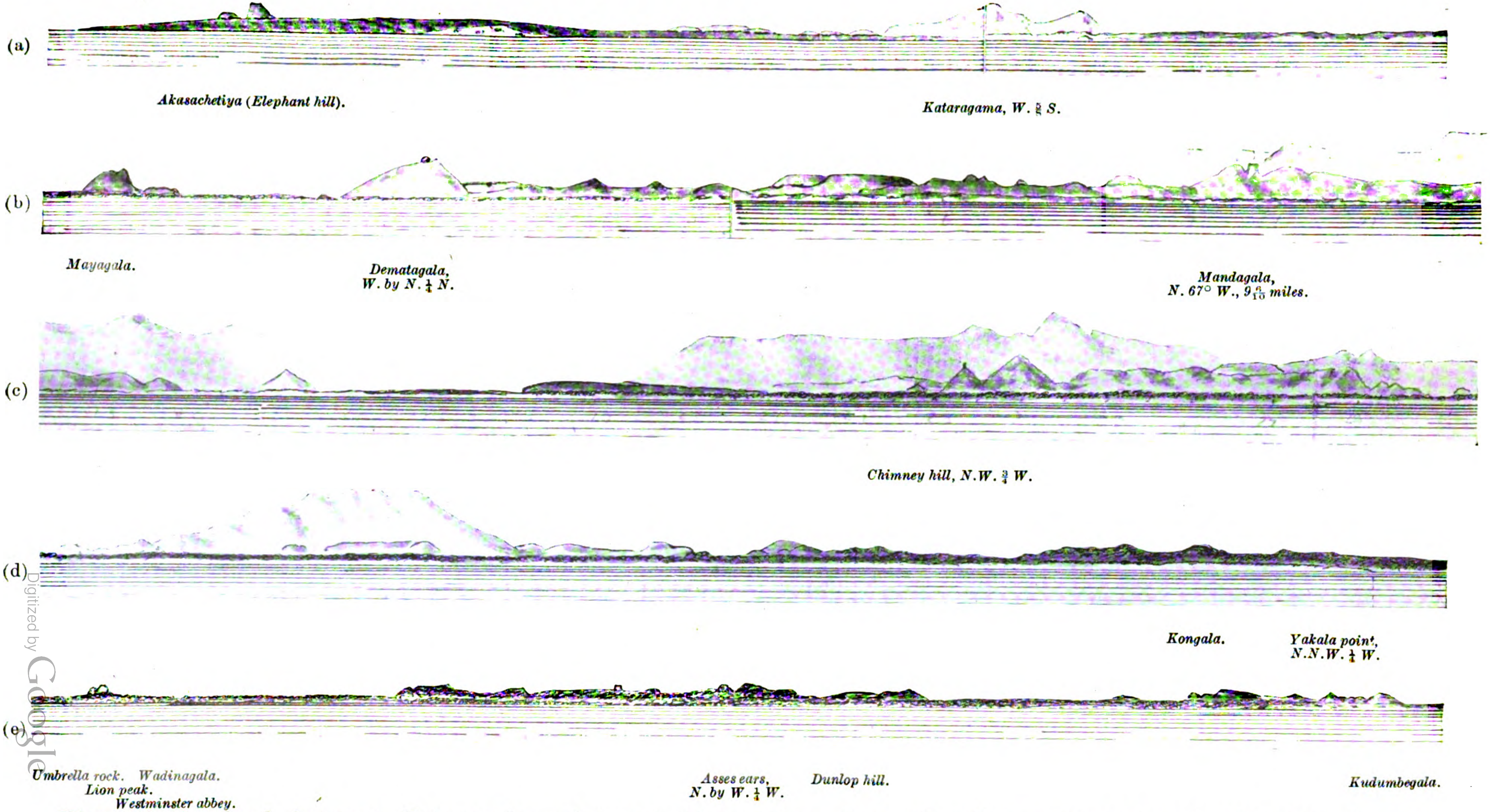
Near Trincomalí, between the months of October and February, there is usually a southerly current of from half a knot to 3 knots an hour, and in March and April and again in August a northerly set of from half a knot to 1¼ knots an hour, while in May, June, July, and in September the current is unappreciable, but irregular currents sometimes run strongly northward, and sometimes southward

CAUTION.—Great care is therefore necessary in navigating near the eastern coast of Ceylon; but the use of the lead should give warning of any approach to danger, the soundings being full and accurate between Kumbukkan aru and Trincomalí.

Yakala, 2½ miles from Illukatiya point, is a small village situated a short distance inland, and invisible from seaward; its locality may be known by a little grassy hillock or mound on the beach about 2½ miles northward of Kumbukkan aru. (View *d*, page 150.)

General charts 828, 70.

To face page 150.]



View of the land between Patanagala point and Chen point, from 3¾ miles north-eastward of Little Basses.

Chart 813, Ceylon, south coast. Var. 1° 0′ W.

Coast.—Asses' Ears, situated 6½ miles northward of Yakala, is a hill, 339 feet high, and Rugged ridge, 2½ miles north-north-eastward of Asses' Ears, is 372 feet high, and easily distinguished. Thence to Panawa, 7½ miles north-north-eastward, the only remarkable objects are a solitary sandhill at 3¾ miles, and Split rock, on the coast, 4¾ miles north-eastward of Rugged ridge. (View *e*, page 150.)

Between Yakala and Rugged ridge the coast is foul to a distance of three-quarters of a mile, Marescaux and Monro rocks being situated respectively 1¼ and 6 miles north-north-east of Yakala.

Panawa (*Lat. 6° 46′ N., Long. 81° 50′ E.*), a sandy ridge covered with jungle, terminates in a scrub-covered rocky point, 85 feet high, which when seen from northward and southward makes as a flat-topped islet. Southward of the point there is a considerable amount of bare sand. Bolt point, nearly 3 miles northward of Panawa, is a rounded and scrub-covered rock, 92 feet high.

Arugam bay, nearly 5 miles northward of Panawa, is a place where coasting vessels ship timber between the months of February and May; a river runs into this bay, but during the survey its mouth was completely barred by sand.

Landing.—Good landing may be effected in the southern corner of the bay.

Nilagalahela, or Saddle peak, 655 feet high, is an isolated hill 8 miles westward of Arugam bay, and has two summits, the north-eastern being a little higher than the other. From the eastward the hill appears as a single peak, steep on the southern side; being the highest hill in the vicinity, and darker in colour than the surrounding country, it is a good landmark.

Sangama Kanda, situated 10 miles northward of Arugam bay, and 3 miles inland, is 283 feet high, and in this vicinity the land becomes higher, with numerous scrub-covered hills between 200 and 280 feet in height, having no well-defined summits. Close southward of the parallel of Sangama Kanda there is a long sandy patch on the coastline, which, with the higher land alluded to, marks the locality of Komuriya and of Komuriya ridge.

From this locality Wadinagala peak or False Hood, Kumburahela, and Westminster Abbey are very conspicuous. Friar's Hood, to the northward, shows up well, while the Pambuthai Malai range extends a good part of the way between Wadinagala and Friar's Hood. (*View on 813.*) (View *e*, page 150.)

Sangama Kanda point, a wooded bend of the coast a short distance north-eastward of Komuriya village, is not noticeable, while the village cannot be seen from seaward.

General charts 828, 70.

Chart 813, Ceylon, south coast. Var. 1° 0′ W.

Depths off-shore.—The soundings off this coast are fairly regular, gradually decreasing towards the land except between Arugam bay and Sangama Kanda point.

Egeria patch, 4 miles in length, in a north-east and south-west direction, and a third of a cable in breadth within the 10-fathoms contour line, except at the southern end, has depths of from 7 to 9 fathoms over it; its north-east extreme is situated nearly 5 miles eastward of Komuriya. The bottom, composed of coral and sand, was clearly seen in a depth of 9 fathoms.

The soundings in-shore of this patch and a position about 2 miles southward of it, are very uneven, and breakers may be caused by winds and currents.

Current.—During an examination of the patch in 1908 the current was found to set to the southward at a rate of 1½ knots.

Komuriya (*Lat. 7° 2′ N., Long. 81° 54′ E.*), composed of sand and coral, and having 2¾ fathoms least water, is about 3½ miles long in a north-north-east and opposite direction, its northern extreme being nearly 1½ miles eastward of Sangama Kanda point. *View on 813.*

COAST.—From Komuriya the coast has a general northerly direction to Batticaloa, a distance of about 38 miles, the land near the sea being low and flat, and in many places cultivated with cocoanut. At 13 to 20 miles inland are several conspicuous mountains, and in clear weather the more distant ranges are visible from off the coast. Of these are Maragalkanda, a long rounded mountain, about 30 miles W. by S.; and Namunakuli (Jubilee hill), a sharp peak, 6,680 feet high, situated 45 miles westward of Komuriya.

Kumburahela (Aganis peak), 1,134 feet high, sugar-loaf in form, and isolated; is about 12½ miles westward of Sangama Kanda point.

Westminster Abbey, 7 miles westward of Kumburahela, is a remarkable mountain; its north-western end, 1,830 feet high, resembling a tower. The mountain is best seen from a position northward of Komuriya, though it is also conspicuous from the southward.

Wadinagala (False Hood), 4 miles north-north-west of Westminster Abbey, is conspicuous from all directions seawards; its summit is precipitous, and forms a sharp peak, 2,413 feet high. (View *e*, page 150.)

Hills.—The lower hills which are noticeable are Thomson hill (706 feet), wooded, 9 miles north-westward of Sangama Kanda point and 7 miles inland; Sharp hill (408 feet), 1½ miles northward of it; and Bennington hill (647 feet), wooded, wedge-shaped, and situated 5½ miles north-westward of Sharp hill.

General charts 828, 70.

Chart 2031, Ceylon, east coast. Var. 1° 0′ W.

Friar's Hood, a mountain 2,148 feet high, 21 miles northward of Westminster Abbey, is well named, and although there are hills round it, is readily distinguished from long distances in clear weather and is unmistakable. This is usually the first prominent landmark made coming from the northward. (*Views on 813, 2031.*)

Depths off-shore.—The soundings between Komuriya and Batticaloa are regular, with the exception of a few rocky patches within a mile of the shore. From the 100-fathoms contour line, which is from 4 to 10 miles off the coast, the depths increase suddenly, and heavy overfalls occur occasionally even in the finest weather.

Alphée shoal, having a depth of 3¼ fathoms, over coral bottom, is about 1¾ miles off the land, due east from Friar's Hood; its extent within the 5-fathoms contour line is about 1½ miles in a north and south direction and three-quarters of a mile east and west.

Batticaloa lake.—Immediately within the coast abreast of Alphée shoal is the southern end of Batticaloa lake, which extends in a north-north-west direction for a distance of about 25 miles, its eastern shore being generally about 1½ miles inside the coast; its greatest width is about 3½ miles, and it is very irregular in outline.

Plan of Batticaloa roads on 2031.

BATTICALOA ROADS (*Lat. 7° 45′ N., Long. 81° 41′ E.*), off the entrance of Batticaloa lake, is an open roadstead, about three-quarters of a mile in width, in an east and west direction, between shoals on either side, the general depths being from 3¾ to 6½ fathoms; there is also anchorage space, in somewhat deeper water, on the western side of the western shoals.

LIGHT.—From a staff at the watch-house, near the river bar, a *white fixed* light is exhibited, at an elevation of 47 feet above high water, which should be visible, in clear weather, from a distance of 12 miles, but has been reported to be only visible 10 miles.

Dangers.—Beacon rock, the outer danger on the eastern side, has a depth of 1½ fathoms over it, and lies 1½ miles east-north-east of the light staff.

Buoy.—A can buoy, painted black, marks the eastern side of Beacon rock.

Brennus shoal, with 1¾ fathoms least water over it, is situated nearly half a mile westward of Beacon rock, and 1$\frac{1}{10}$ miles north-west of the light staff. A 3-fathoms patch lies about 3 cables north-north-west, and another of 2½ fathoms 1¼ cables westward, of Brennus shoal.

Tower rock, with a depth of one fathom over it, is about 1½ cables south-south-eastward of Brennus shoal, and both eastward and westward of it are several patches, best seen from the plan.

General charts 828, 70.

Plan of Batticaloa roads on 2031. Var. 1° 0′ W.

Surveyor rock, on the western side, has 3½ fathoms water over it, and lies about 9 cables northward of the light staff.

Khandalla bank, a patch on which the depth is 3½ fathoms, is situated about one cable south-westward of Surveyor rock.

Buoy.—A conical buoy, painted red, is moored on the north-east side of Surveyor rock.

Note.—The buoys are removed during the North-east monsoon, and replaced about the middle of March; their positions should not be depended on.

Batticaloa lake entrance (*Lat. 7° 45′ N., Long. 81° 41′ E.*) is fronted by a bar on which the depths are from 3 to 6 feet, but its formation changes with each monsoon; it may be crossed without much difficulty during the South-west monsoon, but during the North-east monsoon the entrance is almost inaccessible.

Obelisk.—An obelisk, 25 feet high, and painted white is situated about a cable from the beach, two-thirds of a mile west-north-west of the light staff.

Signal station.—A signal station, watch-house, and a flagstaff are situated on the west side of the entrance, where also are a few houses and the Custom-house. The flagstaff may be seen from a considerable distance, and signals are made by the International code.

Pilots.—The natives at the signal station are acquainted with the bar, and will come off to a vessel on the usual signal being made.

Anchorage.—The roadstead affords good anchorage during the South-west, but is dangerous in the North-east, monsoon, and a good berth for a large vessel is in 7½ fathoms water with the flagstaff bearing S.S.E. ½ E.

A small vessel may anchor about 1½ cables east-south-east of Khandalla bank, in a depth of 6½ fathoms, with the flagstaff bearing S. ¼ E. This is a convenient berth for communicating with the shore.

Directions.—Approaching from the southward the water should not be shoaled to less than 10 fathoms until the Obelisk bears S.W. ¼ W. When in a small vessel steer in and anchor as directed above.

A large vessel should enter with the Obelisk bearing about S. by W.

By night.—Approaching Batticaloa at night, the lead should be constantly used, and in a small vessel the water should not be less than 10 fathoms until the light bears about S. by W. ¾ W.

Tides.—It is high water, full and change, at Batticaloa road, at 5h. 0m. approximately; springs rise 2 to 3 feet.

General charts 828, 70.

Plan of Batticaloa roads on 2031. Var. 1° 0′ W.

Town.—The town of Batticaloa, the head-quarters of the Civil Administration of the eastern province, is situated 3 miles southward of the entrance to the lake; in 1901 it had a population of 9,969.

Communication.—The steamers of the Ceylon Steamship Company call twice every week, but seldom communicate during the North-east monsoon. There is a post and telegraph office, and a good road between the signal station and the town, which are connected by telephone.

Supplies of fresh meat, bread, and vegetables may be procured; water is brought off in casks.

Winds.—Easterly winds prevail more or less throughout the year at Batticaloa, between north and east from November until the middle of April, and between south and east from the middle of April until October. Westerly winds form about one-fifth of the whole, and occur at any time, but are most frequent in July and August, and north-westerly winds are common in January. Calms average about three days in each month.

Chart 2031, Ceylon, east coast.

Depths off-shore.—Between Batticaloa and Foul point the soundings are regular beyond the 10-fathoms contour line; and the 100-fathoms contour line is generally from about 9 to 13 miles off the land, but off Puna kuda point a narrow cleft of deep water extends in from seaward, and the 100-fathoms line of soundings is only 2 miles from the shore.

On the edge of the bank of soundings the depths increase suddenly; heavy overfalls occasionally occur, even in the finest weather.

Navigation on this coast is safe in thick weather if the lead is used and depths maintained of not less than 20 fathoms, which depth is found at distances of from 2 to 7 miles from the land.

COAST.—From the entrance to Batticaloa lake the coast trends north-westward for a distance of 6 miles to Puna Kuda point, off which a reef extends over half a mile; on the northern side of the point is a bight named Puna Kuda.

Tower hill (*Lat. 7° 38′ N., Long. 81° 24′ E.*), 15 miles west-south-west from Puna Kuda point, is 800 feet high, and hog-backed, with a conspicuous rock at its summit resembling a tower.

Barons Cap, formerly known as Sugarloaf, a hill 691 feet high, situated 13½ miles westward of Puna Kuda point, has the appearance of a sugarloaf from the eastward and southward, and when clear of other hills is conspicuous, especially when bearing about W. by N.; from the north-eastward its top appears broader, but it is mingled with the hills to the southward.

Vendelus point, 6 miles north-north-westward of Puna Kuda point, has reefs, on which are Baker rocks, extending 1¼ miles north-eastward from it, and in other directions for a quarter of a mile.

General charts 828, 70.

Chart 2031, Ceylon, east coast. Var. 0° 50′ W.

Kal Kuda (Rocky bay), on the south side of Vendelus point, and so named from a number of sunken rocks encumbering it, may possibly afford good shelter during the North-east monsoon for small vessels, in depths of from 2 to 3 fathoms close in-shore.

Dangers.—A rocky patch, with 1¾ fathoms least water over it, lies one mile southward of Vendelus point, and a rock with a similar depth is situated about 9 cables south-south-west of the point.

Beacons.—A white dome-shaped beacon, surmounted by a ball, stands on the extreme of Vendelus point.

Two beacons, each 60 feet high, and surmounted by a tripod, are on the land about 1¾ miles south-westward of Vendelus point. The front beacon is painted white, the rear beacon red, and when in line bearing N. 79° W. they lead to the southward of the rocky patch with 1¾ fathoms water over it, above mentioned.

Two beacons, similar to the above leading beacons, but only 45 feet in height, are on the north-western shore of Kal Kuda bay, a quarter of a mile eastward of the rest-house.

Anchorage.—The beacons, on the north-western shore of Kal Kuda, when in line will lead to the anchorage.

Vendelus bay, named by the natives Passi Kuda, lies northward of Vendelus point. Valaichchenai river falls into this bay, around the shores of which shoal and foul ground extends for the distance of a mile.

Coast.—The land between Batticaloa and Vendelus bay has numerous cocoanut trees on it, while between Vendelus bay and Foul point, 35 miles north-north-westward, there is nothing but jungle.

Clarke point (*Lat. 8° 0′ N., Long. 81° 33′ W.*), nearly 5 miles north-north-west of Vendelus point, is low, and surrounded by rocks and foul ground. Elephant rock, 60 feet high, and light in colour, lies off its northern extreme.

Gunners Quoin, a large wedge-shaped mountain, 1,737 feet high, and situated about 25 miles west-south-west from Clarke point, is a good mark. (*View B on 2031.*)

COAST.—From Clarke point to Foul point, a distance of 35 miles, the coast, trending in a north-north-west direction, is low, covered with jungle, and the hills inland are few and unimportant. Several conspicuous rocks above water lie at short distances from the land.

Kirimechiodai Malai, a hill, 7 miles westward of Clarke point, is 185 feet high, but is only seen when bearing between about W.S.W. and W.N.W., when it appears as a low, wedge-shaped hill with a little peak, rising steeply from the southward and sloping to the northward.

General charts 828, 70.

Chart 2031, Ceylon, east coast. Var. 0° 50′ W.

Kunchan Kallu, 3½ miles further westward, is 410 feet high, and from the south-eastward appears wedge-shaped, and moderately steep to the southward; from the north-eastward it has no well-defined summit.

Small Quoin, 4¼ miles west-north-west of Kunchan Kallu, is 518 feet high, and from the south-eastward it slopes to a small rounded summit. (*View B on 2031.*)

Chelitivo is a small wooded islet about 30 feet high half a mile from the coast, and 8½ miles north-north-westward of Elephant rock.

Panditivo point, 4¼ miles northward of Chelitivo, is sharp, rocky, and has a small rock above water close to it.

Kadeawella point (*Lat. 8° 13′ N., Long. 81° 26′ E.*), 1¾ miles further northward, has rocks lying about 4 cables off it, the highest of which is 10 feet above high water.

Virgel rocks, 2½ miles northward of Kadeawella point, and about a mile distant from the shore, consist of two sunken rocks and one 3 feet above water.

Tree rock, about 3 cables from the shore and 5 miles northward of Kadeawella point, is 43 feet high, and there is a tree on it. A rock, 2 feet above high water, lies half a mile eastward of Tree rock.

Alligator rock, 3 feet high, is rather more than 1½ miles from the shore, with a sunken rock close to its north-east side.

Ship rock, 62 feet high and conspicuous, lies nearly a mile in-shore of Alligator rock. There is also a noticeable patch of rock on the coast within these rocks and 1½ miles northward of Tree rock.

Ilantattunu river mouth, 4¼ miles northward of Tree rock, has several detached islets off it, the highest of which, 60 feet high, with trees on it, is remarkable.

White rock, on the beach 3 miles further north, and 25 feet high, shows well during the forenoon.

Heming rocks form a group which extends north-eastward 1¼ miles from White rock; the highest is 20 feet high, and the north-eastern rock, 7 feet high, is a mile off-shore.

Plan 815 of harbour and bays of Trincomalí. Var. 0° 40′ W.

FOUL POINT, on the south side of the entrance to Trincomalí bay, is low, and covered with cocoanut trees; a reef, with depths of from one fathom to 3½ fathoms over it, extends in a north-north-west direction from it for a distance of 8½ cables to the 5-fathoms contour line.

General charts 828, 70.

Plan 815 of harbour and bays of Trincomalí. Var. 0° 40′ W.

Munayai Paru, a coral patch consisting of large boulders, nearly a cable in length in a north-east and south-west direction, and half a cable in breadth, with a least depth of 2½ fathoms over it and 6 to 8 fathoms close around, lies 1¼ cables north-north-west of the 5-fathoms contour line, which forms the extremity of the shoal water extending from Foul point, from which it is distant nearly one mile.

Clearing mark.—Beacon rock open westward of Norway island bearing S. 40° W. leads north-westward of Munayai Paru, and of Northesk rocks.

LIGHT (*Lat. 8° 32′ N., Long. 81° 19′ E.*).—Near the extreme of Foul point, a cylindrical tower, 120 feet in height, and painted grey, exhibits, at an elevation of 104 feet above high water, a *white fixed* and *flashing* light, showing a flash *every half minute,* which should be visible from a distance of 17 miles in clear weather; the *fixed* light between the flashes is not seen from a distance of more than 10 miles.

TRINCOMALÍ BAY, about 5½ miles across at its entrance between Foul and Flagstaff points, and narrowing to 2½ miles between the 5-fathoms contour lines at 2 miles further in, is divided into Great bay, which has low shores, and recedes about 4½ miles in a south-west direction from a line joining Norway point and Chapel island, and Trincomalí harbour, extending, with many arms, 3 miles in a north-north-west direction from Great bay. It affords capacious and safe anchorage to vessels of all sizes and at all seasons.

Depths.—On the northern side of the channel between Norway point and Chapel island, except near the shore, the water is very deep, but the 100-fathoms contour line runs roughly through the centre of the channel, and southward of it the depths shoal towards Norway point; the centre of Great bay is also deep, but shoals towards the bays on the east and west sides.

A vein of comparatively deep water, from 21 to 45 fathoms, occupies the centre of the channel into Trincomalí harbour, but in the centre of that harbour the depths are from 8 to 14 fathoms, shoaling in the various arms.

Norway point is 2¾ miles west-south-west of Foul point, the coast between being low and forming a shallow bight.

Northesk rocks, nearly 3 cables in length in a north-east and south-west direction, and over a cable in breadth, with 1½ fathoms least water over them, lie about 1$\frac{2}{10}$ miles north-eastward of Norway point, and a rock, awash, lies 3½ cables northward of the point.

Three islets lie off the western side of the Norway point. The first, unnamed, is about 2 cables north-west; Norway islet is about 3½ cables westward; and Smooth islet 2½ cables south-south-west of it.

General charts 2031, 828, 70.

Plan 815 of harbour and bays of Trincomali. Var. 0° 40′ W.

Beacon rock is about 2½ cables south-westward of Norway islet, and 6 cables from the point.

Depths off-shore.—From the shore of the bight contained between Foul and Norway points shoal water extends about 4 cables, the 5-fathoms contour line being about half a mile off. Shoal water extends about half a mile westward of Norway point, and southward of the point is Norway sand, which is shoal for a distance of about three-quarters of a mile westward from the land, and for a distance of nearly 1½ miles to the southward of the point.

GREAT BAY, in which, as already mentioned, there is a large area of deep water, sweeps round from Norway point in a semi-circle to Marble point, 4 miles to the westward. Its shores are low, and the Sambore and Kottia rivers, the Mahaweli ganga, and Upá or Stately river flow into the bay.

Dangers.—Sambore shoal, with a depth of 2¾ fathoms, over rock, lies about 4 cables north-west of the western entrance point to Sambore river.

Kottia sand, with depths of from 3 to 4 fathoms on its northern edge, stretches along the shore from Sambore river to Mahaweli ganga, fronting Kottia river at a distance of 6 cables from it.

Tamblegam shoal, with a least depth of 1½ fathoms, is distant 5½ cables from the western shore of the bay, and lies on a shoal flat which extends about three-quarters of a mile from that shore, between Upá river entrance and Marble point.

Tamblegam spit, near the northern end of the above shoal flat, extends for about three-quarters of a mile in a south-east direction from the entrance to Lake Tamblegam, which entrance is well marked on its northern side by Naditivu islet.

Naditivu islet, situated 7 cables west-south-west from Marble point, and 2 cables from the shore, is 37 feet high, rocky, and with trees on its summit. Foul ground extends from its southern extremity, forming a spit a quarter of a mile long and three-quarters of a cable broad, and there is shallow water between the islet and the shore.

Plan of Trincomali harbour on 816.

APPROACHES TO TRINCOMALÍ HARBOUR.—

Marble point (*Lat. 8° 31′ N., Long. 81° 13′ E.*), when seen from the eastward, appears as a small rounded hill, 99 feet high, terminating to the southward in a rocky ridge about 3 feet high, the hill being apparently connected by a low flat neck, with Diamond hill, the next summit, to the northward.

General charts 2031, 828, 70.

Plan 816, Trincomali harbour. Var. 0° 40′ W.

Shoal water surrounds the point, the 3-fathoms contour line being one cable eastward, and a quarter of a mile southward, of it, and, if landing, care is necessary to avoid foul ground extending half a cable from the shore on its north-west and south-west sides; a rock, awash, in a small bay northward of Diamond hill is a distinct danger to boats.

Beacon.—A conical-shaped concrete beacon, painted white, and surmounted by a staff and triangle, apex down, marks Marble point.

Niger rock, a small boulder with 4 feet water over it, and surrounded by depths of from 2½ to 4½ fathoms, lies 4 cables south-eastward of Marble point.

Plan 815.

Pigeon or Elizabeth island, situated 9 cables south-eastward of Marble point, is conical in appearance when seen from the northward, composed of bare rocks, and has a well-marked summit 55 feet high. It is surrounded to a short distance by rocks and shoal water.

A small patch with a depth of 7 fathoms over it and from 10 to 18 fathoms around lies half a mile north-eastward of Pigeon island.

Plan 816.

ROUND ISLAND, about one cable in length in a north-east and opposite direction, half a cable in breadth, and 50 feet in height, lies 8 cables east-north-east from Marble point; a group of rocks, above water, and of a maximum height of 15 feet, lies one cable off its south-west extreme, with a boat passage between.

The 5-fathoms contour line surrounds the island, and the group of rocks off its south-west end, at a distance of about a third of a cable, except on the northern side, where it is a cable off; there is a foul area half a cable in width off this part of the island, in which is a rock awash at low water and generally breaking.

LIGHT (*Lat. 8° 31′ N., Long. 81° 14′ E.*).—On the summit and near the centre of Round island is a cylindrical tower, 69 feet in height and painted white, from which is exhibited, at an elevation of 103 feet above high water, a *white fixed* light, which should be visible, in clear weather from a distance of 10 miles.

Beacon.—A conical-shaped concrete beacon, painted white and surmounted by a staff and triangle, apex up, stands on the north point of Round island.

Landing can be effected on either the north-east or the south-west points of the island, according to the monsoon.

COAST.—The coast between Marble point and Clappenberg point, a distance of 1¼ miles, is indented by three small sandy bays, separated from each other by broad rocky points, with boulder-strewn shores. The first dividing point rises to Diamond hill, a woody and fairly conspicuous summit, 297 feet in height, and off the point is White Top rock, a confused mass of rocks just detached from its northern extreme; this rock is 22 feet high, and, being conspicuous by its whitewashed summit, forms a convenient mark when approaching the harbour.

Dead Man's cove, the northernmost of the three bays, has a small village amongst trees inside the coastline, but it is not visible from seaward; a mosque on a small eminence in the northern part of the cove, being white, is fairly conspicuous when seen clear of the trees.

Clappenberg point (*Lat. 8° 32′ N., Long. 81° 13′ E.*) is the eastern extreme of a remarkable narrow, cockscomb ridge, which forms a straight, bare, cliffy wall on its southern side, and extends half a mile east-north-east from the north end of Dead Man's cove; it has two summits, 128 and 97 feet in height, respectively, with small shrubs along the crest, and at 3½ cables westward of the point it is broken by a precipitous gap to the water line, about a quarter of a cable in width, and just covered at high water.

Beacon.—A beacon of masonry, 10 feet in height, painted black and white in bands, and surmounted by a small cage, stands on Clappenberg point.

Clappenberg hill (Kari Malai Utu Malai), 362 feet high, and covered with dense jungle, has a double summit, and is situated about one mile westward of Clappenberg point.

Eastern side.—Elephant point, the south-western extreme of Trincomalí peninsula and the eastern entrance point to the harbour, is 8¼ cables east-north-east of Clappenberg point, and may be easily recognised by the low bastion of an old fort, standing on the extreme of the small flat promontory forming the point, which is a few feet above water.

The land behind Elephant point rises somewhat steeply and, trending in a north-easterly direction, attains a height of 354 feet in Elephant ridge.

The coastline from Elephant point, stretching in a north-east direction for 1$\frac{2}{10}$ miles, is at first low, but afterwards fronted by cliffs, of no great height, and with narrow sandy beaches strewn with boulders in places.

Elephant island, 3 cables in length in a north-east and opposite direction, is situated 4 cables south-eastward of Elephant point;

Plan 816, Trincomali harbour. Var. 0° 40′ W.

its eastern part is 117 feet high to the top of the trees, with which it is covered, but the western portion is a narrow rocky point, terminating in a small cone, 8 feet above water and whitewashed.

There is a boat passage between Elephant island and the main island, but foul ground extends for a distance of 2 cables north-eastward of the north-eastern point of the former island.

Plan 815 of harbours and bays of Trincomali.

Chapel point is of rounded shape, and the land behind it rises somewhat steeply to Chapel hill, 329 feet high, which forms the eastern end of Elephant ridge; from this point the coast trends to the northward. (*See* also page 171.)

Chapel hill is covered with jungle, but the remainder of the ridge is more sparsely wooded, and, in places, between the trees are long vertical streaks and spaces of red earth.

Chapel island (*Lat. 8° 33′ N., Long. 81° 15′ E.*), of rocky formation, nearly a cable in length and 32 feet in height, is 1¼ cables south-eastward of Chapel point. The northern part of the island is flat, with trees and bushes, but the higher portion is bare rock, the summit being a large square-topped and flat-fronted boulder.

A chain of rocks, the highest about 4 feet, extends 1½ cables south-west, and a similar chain, not so noticeable, projects a quarter of a cable from its north-east extreme. The passage inside the island, being shoal and foul, can only be used by quite small boats.

Plan 816, Trincomali harbour.

OFF-LYING DANGERS IN THE APPROACH.—Western side.—Grommet rock, 4 cables southward of Clappenberg point, is a third of a cable long in a north-east and opposite direction, and about half that wide; it is awash at low water, and is fronted by depths of from 3¼ to 8 fathoms. The rock generally breaks during the South-west monsoon, but on a calm day it is not visible.

Hatam Urita Kalle, lying to the north-westward of Grommet rock and 3½ cables southward of Clappenberg point, is of small extent, has 5 feet water over it, and is surrounded by depths of from 2¾ to 3¾ fathoms.

Minden rock, also of small size, and with 2½ fathoms water over it, lies 3¼ cables south-eastward of Clappenberg point, and is surrounded by depths of from 7 to 12 fathoms.

Nade Munai Paar, nearly two-thirds of a cable west-north-west of Minden rock, has 1¼ fathoms water over it, and from 6 to 10 fathoms around. This danger and Minden rock seldom break, nor show in any manner, and the lead gives no warning of an approach to them.

Pandi Aricha Munai Paar, with a depth of 4¼ fathoms over it, and 6 to 9 fathoms around, lies 1½ cables north-eastward of Clappenberg point.

Eastern side.—Elephant rock, a small rocky head, with 4 feet water over it, and depths of from 3¼ to 5 fathoms around, lies 1¼ cables westward of the south-west extreme of Elephant island.

Buoy.—A can-shaped wooden buoy, painted white, is moored in 6½ fathoms water a quarter of a cable south-westward of the rock, but as it floats low in the water it is not easily made out, especially if a strong current is setting past the point.

TRINCOMALI HARBOUR (*Lat. 8° 33′ N., Long. 81° 14′ E.*), the area enclosed to the northward of Clappenberg and Elephant points, may be considered to be the only entirely sheltered natural harbour, not only in Ceylon, but throughout the whole of the Indian peninsula.

It extends in a northerly direction, its shores being indented by several picturesque bays and coves, separated by hilly, wooded points, and it encloses numerous islands and islets. The length is about 2½ miles, and average breadth 2 miles, but the southern half, which contains Great and Small Sober islands, has much less water area than the northern.

Depths.—A vein of deep water, with depths of from 21 to 44 fathoms, extends from the entrance between Clappenberg and Elephant points for about 1¼ miles into the centre of the harbour, where there is an area nearly a mile in extent with depths of from 11 to 18 fathoms, and inside the 10-fathoms contour line, which surrounds this area, the depths shoal fairly regularly into the various bays and coves; the anchorage off the dockyard is in about 11 fathoms.

Western shore.—The western shore is indented by four principal bays, containing several coves, each divided from the other by promontories of various shapes and lengths; the land behind is hilly, attaining heights of from 300 to 400 feet.

The shores of this side of the harbour are but sparsely inhabited, and are little visited, although the main road to Batticaloa runs southward close behind the general line of the coast, crossing the entrance to Lake Tamblegam by a ferry.

Eastern shore.—The eastern shore is formed by a peninsula, consisting of Elephant and Ostenberg ridges, two straight-topped hills, 354 and 276 feet high, lying parallel to one another in a north-easterly direction. Nicholson cove, a narrow inlet, lies between them.

This peninsula is an Admiralty and War Office reserve, and the northern base and slopes of Ostenberg ridge have on them the buildings of the naval and military establishments formerly maintained here.

A flat isthmus joins these ridges with Fort Frederick (a high and fortified promontory of the outer coast, hereafter described) and with a second pair of wooded ridges, each about 100 feet high, lying parallel to one another in the northern part of the harbour, and having nearly the same direction as Elephant and Ostenberg ridges.

Yard cove, shallower and longer than Nicholson cove, is between the second pair of ridges.

Trincomalí town occupies the northern part of the isthmus above mentioned, reaching from the inner to the outer coast, and is fronted by lines of islets and shoals parallel to the ridges.

Beacons.—Concrete beacons, conical-shaped, painted white, and surmounted by triangles, stand on Plantain and Middle points; the topmark of the former is apex up, and of the latter apex down.

Great Sober island (*Lat. 8° 32′ N., Long. 81° 13′ E.*), in the south-west part of the harbour, is 6 cables long, in a north and south direction, and 4 cables broad, rising to a wooded summit, 226 feet high.

There are three bungalows, for the use of naval officers on the East India station, on the north side of Great Sober island, and a white flagstaff stands in the grounds.

Landing.—Two piers are on the north side of the island, and a small stone jetty, with from 6 to 8 feet water alongside, is situated in Orlando cove on the east side.

Small Sober island, triangular-shaped, 2 cables in extent and 133 feet high, is joined to the eastern side of Great Sober island by a causeway.

Great and Small Sober islands divide the harbour just inside its outer entrance between Clappenberg and Elephant points into two channels, that on the western side being named French pass, which, being narrow, shallow, and dangerous, and its northern end nearly closed by a ridge of rocks and shoal water, reduces the channel to a width of about a third of a cable, with a depth of 3 fathoms; it is useless for the purposes of navigation, and should be used by boats with caution.

The main entrance between the eastern extreme of Small Sober island and Ostenberg point, the western termination of the ridge of the same name, is 2¾ cables in width, with depths of from 14 to 30 fathoms.

Plan 816, Trincomalí harbour. Var. 0° 40′ W.

Islets and dangers.—Western side.—Sister shoal, with 5 feet water over it, lies in the centre of the entrance to Malay cove, and northward of the north-west point of Great Sober island.

Round Point shoals are two shoal patches a cable apart and the same distance northward of Round point, which divides Malay cove from China bay; the eastern has a depth of 2¾ fathoms, and depths of 11 and 13 close-to on its eastern side. The western, on which the depth is 4¼ fathoms, is surrounded by depths of 5½ to 7 fathoms.

The above are the most outlying dangers on the western side, and others will be best seen by reference to the chart.

Eastern side.—Dockyard shoal, about three-quarters of a cable in extent, consists of two rocky heads with less than one fathom water over them; it lies 1¼ cables north-westward of the white flag-staff which stands in front of the Naval yard, immediately northward of Ostenberg point.

Buoy.—A conical buoy, painted white, marks the western edge of Dockyard shoal.

York island (*Lat. 8° 33′ N., Long. 81° 14′ E.*), about a cable in length and half a cable in breadth, is wooded, the tops of the trees being 77 feet high; it lies 6 cables north-north-eastward of the Dockyard flag-staff.

Beacon.—The extremity of a narrow shoal, which dries at low water and extends 1½ cables north-eastward of York island, is marked by a beacon, painted white.

York shoal, on which the depths are from 4 to 5 feet, is the extreme of a shoal, with from 1½ to 2½ fathoms water over it, extending 4 cables west-south-west from York island.

Buoy.—A conical buoy, painted white is moored off the western end of York shoal, where the depths are from 5½ to 6 fathoms.

Kerbela rock, three-quarters of a cable northward of York shoal, of which it may be considered an extension, is of small size, with 2½ fathoms water over it, and has depths of from 6½ to 8 fathoms on all sides but the south.

Powder island is 6 cables north-west of Admiral's house, which latter is a large flat-roofed building, painted white, with a white flagstaff, and standing among large trees and palms. The island is about one cable in length and half a cable in width, covered with trees and shrubs, the tops of which are 30 feet high; it stands on a rocky plateau, 3 cables in length, which dries at low water, and between it and the shore the depths are only 3 feet.

General charts 815, 2031, 828, 70.

Plan 816, Trincomalí harbour. Var. 0° 40′ W.

Little Powder island, on a similar but smaller, rocky plateau to Powder island, consists of a rocky boulder, 10 feet high, and a very small sandy islet, with some mangroves on it, that nearly cover at high water; it is 2½ cables westward of Powder island.

Beacon.—A conical-shaped concrete beacon, painted white and surmounted by a staff and triangle, apex up, stands on Little Powder island; a similar beacon, except that the apex of the triangle points downwards, stands on the beach abreast the island.

Powder rocks (*Lat. 8° 34′ N., Long. 81° 14′ E.*), a group of four low black rocks, the highest 9 feet with some mangrove bushes, lies, with a few scattered boulders, some of which dry, on the western extreme of the same tongue of shoal water on which stand the two islands; the rocks lie about three-quarters of a mile westward of Admiral's house, and the 5-fathoms contour line is about 1¾ cables westward of the extreme of the shoal tongue on which they stand.

Pier.—Kachcheri pier, about 4 cables northward of Admiral's house, is of wood, and about 300 feet in length, with a depth of 6½ feet at its end, where there is a one-ton crane, and 5 feet at the landing steps, on the southern side; it is roofed for a short distance at its inner end.

Lights.—A *red fixed* light is shown from the end of the pier. A *green fixed* light is shown on the Hospital landing pier, and a *red fixed* light in the Naval yard, when a British vessel-of-war is in port.

Quarantine.—Vessels, without a properly-qualified medical officer, are not permitted to communicate with the shore, nor to allow any person, except the pilot, to board them until permission is given by the health officer.

Cases of infectious disease are not to be landed without the knowledge and consent of the Government health officer, even from vessels carrying a properly qualified medical officer.

The regulations governing vessels having on board plague, cholera, or yellow fever, and the signals required from all vessels arriving off the port, are the same as those for Colombo. *See* page 101.

Calibrating range.—A calibrating range, for the use of H.M. vessels of war, has been established in Trincomalí harbour. The vessel calibrating is moored in the north end of China bay, and fires down the harbour, at a target, temporarily moored 2 cables eastward of Round island.

When the range is in use, warning of the approach of vessels is given from the lighthouse to the vessel firing, and a lookout man with a red flag is posted on the eastern extreme of Small Sober island, to make signals concerning boats approaching the line of fire.

General charts 815, 2031, 828, 70.

Plan 816, Trincomalí harbour. Var. 0° 40′ W.

Anchorages (*Lat. 8° 34′ N., Long. 81° 14′ E.*).—H.M. vessels of war usually anchor or moor off the Naval yard, in a depth of about 11 fathoms, and merchant vessels in the bay to the northward, off Kachcheri pier and Custom-house, but good anchorage can be found in almost any part of the harbour in fine weather.

The South-west monsoon is usually strong in the harbour, and attains a strength of from 6 to 7 of Beaufort scale, and although there is no swell it occasions a ‘, wind slop,” always unpleasant, and sometimes even dangerous to boats.

On such occasions the most sheltered anchorage in the harbour, and convenient to the town, will be found in Orlando cove, in a depth of 15 fathoms, with the north-east point of Great Sober island in line with Round point, bearing N. 44° W.

A still more convenient and sheltered anchorage is in Dutch bay, on the outside coast, which will be found described on page 172.

Quarantine anchorage.—The quarantine anchorage is in the Inner harbour off Plantain point.

Pilots.—Pilotage is compulsory for all vessels over 200 tons proceeding to enter the harbour; pilots board steam vessels approaching near Chapel rock, but sailing vessels receive them in deep water further seaward.

Vessels making the usual signal for a pilot will be answered from the Fort Frederick flagstaff.

Pilotage rates.—The pilotage charge for both entering and leaving is Rs.7.50.

Directions.—Steam vessels.—From the southward, pass 2 miles eastward of Foul point, then steer N.W., and when Round island bears W.S.W. alter course to W. by S. ½ S. for White Top rock. Keep this course till Round island lighthouse bears S. ⅞ E., when proceed up the channel to Ostenberg point with the lighthouse on that bearing astern—if anything, to the eastward of the line.

From the northward steer for Foul point lighthouse with it bearing South until Round island lighthouse bears S.W. by W., when alter course for that island. When Chapel island bears N.W. by N. steer for White Top rock, W. by S. ½ S., and proceed as before.

Sailing vessels.—With a fair wind follow the directions for steam vessels.

It is sometimes difficult for sailing vessels to work into Trincomalí bay against a westerly wind, as there is then occasionally a strong outset from the southern part of the bay. In the South-west monsoon it is usual to make the land southward of Trincomalí. To avoid the outset, work up eastward of Flagstaff point to clear Rocky point and

Chapel rock, until Round island just touches Marble point bearing S. 70° W., which is a good tacking mark until well westward of Norway island.

In approaching the southern part of Great bay keep the lead going, and do not shoal the water to less than 12 or 14 fathoms. Pass close eastward of Round island, and thence the harbour's mouth will probably be reached without a tack.

Tides.—It is high water, full and change, at Trincomalí at 9h. 23m.; springs rise 2 feet, neaps 1½ feet, but both high and low water heights are affected by diurnal inequality.*

Tidal streams or currents.—A stream, apparently tidal, is felt in the vicinity of Round island, where it runs in an east-south-east and opposite direction, sometimes attaining a rate of 1½ knots.

Sufficient observations do not at present exist to determine the direction and velocity of the currents in the harbour during the South-west monsoon, but a series taken during the month of December shows that the surface water is then practically always running out, at both the main entrance and French pass, and chiefly at the former, at rates varying from half a knot to one knot in the centre, but with considerably greater velocity by the shore.

After passing Elephant point the current sets very rapidly to the south-east, and passes the western point of Elephant island at a rate of from three-quarters of a knot to one knot; the stream, coming from French pass, setting past Clappenberg point, and generally running in the direction of Round island at a little less than half a knot.

Observations made of the current at a depth of 10 fathoms in the harbour entrance showed that the water at that depth was generally running inwards, as would seem necessary to counter-balance the continuous outflow at the surface.

The rate, however, was rarely more than a half that of the outgoing stream, so that it may be presumed that the former must be of considerable depth in order to supply a sufficient volume of water to make up for the more rapid outflow, and so to preserve the actual water level.

It is reported that during floods the discoloured water from the Mahaweli ganga, which discharges into Great bay, 5 miles south of the harbour, enters the latter, and that on such occasions the surface water is nearly fresh.

TOWN (*Lat. 8° 33′ N., Long. 81° 15′ E.*).—The town, which derives its name from the Tamil name of Fort Frederick headland, Trinkinia Malai, signifying the three-cornered mountain, is on the northern part of the isthmus on the north-east side of the harbour, the native part, laid out in more or less regular streets, being fairly well built. The European bungalows stand in compounds and gardens, in more scattered manner to the southward, and are divided by shady roads. There are also some native houses in this locality, and the Roman Catholic chapel, with a conspicuous white dome.

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* Full predictions for the port appear in the Tide Tables for the Indian ports, published annually.

The Kachcheri or Government offices, the post-office, and the offices of the Government departments face the north-east side of the harbour.

Prominently visible from the harbour, among the trees on the northern slope of Ostenberg ridge, are the unoccupied military barracks, and an open grass space between the town and Fort Frederick, is known as the Maidan, and used as a recreation ground; the Little Maidan is a second open space at the southern end of the town. In 1901 the population, exclusive of the military, was 10,614, of which 56 were Europeans.

Communication.—The Ceylon Steamship Company have a regular service of two steamers weekly between Trincomalí, Colombo, and Pamban, calling at some intermediate ports.

Mails are sent, and arrive, once daily, by coach which runs to Mátale, which is connected with the railway system near Kandy.

There is telegraphic communication with all parts, *viâ* Anuradhapura and Colombo.

Supplies.—Fresh meat, bread, and vegetables may be procured in quantity, if previous notice be given, and there are ship chandler's shops in the town, where small supplies may be obtained.

Water, supplied from large wells in the town, is brought on board in casks and iron drums.

Caution.—The water from some of the wells, is not of good quality all the year round, and enquiry regarding the source of supply is advisable.

Repairs.—The only repairs that can be effected are of a temporary nature, to enable a vessel in distress to reach another port. Besides the one-ton crane already mentioned on Kachcheri pier, there are 2½-ton derricks at the Naval yard and two 5-ton cranes at the Military pier.

Hospitals (*Lat. 8° 34′ N., Long. 81° 15′ E.*).—The Government hospital is near the beach, at the southern end of Dutch bay, and application should be made to the medical officer in charge, as there are no special regulations regarding seamen.

The infectious diseases hospital is on an eminence, fronted by a small bay, and north-eastward of Plantain point.

Landing places.—There are a number of landing places between the Naval yard and the town.

Plan 816, Trincomalí harbour. Var. 0° 40′ W.

The Naval yard (*Lat. 8° 33′ N., Long. 81° 14′ E.*) is fronted by a stone sea wall, with depths of from 5 to 6 feet close outside it; of the three landing steps here, the southernmost has 3 feet, that at the flagstaff 5 feet, and at the officer's landing there is 3 feet water.

Further north-east at the Hospital steps there is from 4½ to 5 feet at a small concrete pier.

The Military pier, with a square head, has 7½ feet at the southern, and 6½ feet at its northern corner, but in going alongside the latter care is necessary, as there is a line of drying rocks close to it.

The Captains landing, inside York island, has only a depth of one foot alongside.

The Admirals landing has 3 feet water round the head of the pier. The Kachcheri pier has been already mentioned, and a short distance northward of it, are steps at a jetty, with depths of 2 and 3 feet alongside.

Trade.—The principal, and almost only, export is timber, chiefly satin wood, and the chief imports are food stuffs, cotton and silk goods, wearing apparel, kerosene, and other oils; in 1906 the former were valued at £1,558 and the latter at £53,192. Six small native sailing vessels, of an aggregate tonnage of 275 tons, belongs to the place.

Climate.—The climate of Trincomalí differs from that of the southern and western coasts of Ceylon, and bears a greater resemblance to that of India, southward of Madras.

The average annual temperature is 81·5° Fahr., and the average daily range is 14·5°, but the temperature in June and July is usually considerably over 90° on board during the heat of the day; the weather, however, being very dry, this does not cause inconvenience.

The South-west monsoon usually commences about the 20th May, and blows, at Trincomalí, with much greater force and steadiness than on the western side of Ceylon. It differs in being exceedingly dry, the mountains in the interior, over which it has passed, having caused precipitation of all its moisture.

During the prevalence of the South-west monsoon its force is commonly about from 3 to 4 at night, and this continues until 8 a.m., when it quickly increases in strength, until, in the middle of the day, it has reached a force of from 7 to 8; as already mentioned at page 167 the "wind slop" spoken of renders the whole surface of the harbour white with small breaking waves, sometimes dangerous to boats. At from 4 to 5 p.m. the force moderates for the night.

Towards the end of July, and at the beginning of August, there are usually showers in the late afternoon, but the beginning of the North-east monsoon is not felt till about the 15th October.

General charts 2031, 828, 70.

Plan 816, Trincomalí harbour. Var. 0° 40′ W.

Full monsoon conditions of heavy swell on the outer beaches, with wind and rain storms of comparatively short duration, but of extraordinary violence, do not become general until the end of November.

The average rainfall for the year is 61·48 inches, most of which falls during October, November, and December. The months of February and March are cool and pleasant, though not very healthy, with little wind and fine clear weather.

During the North-east monsoon, calms are somewhat frequent.

Trincomalí, on the whole, may be considered as healthy, the dry season, from May to September, being the healthiest part of the year.

The prevailing diseases are malarial fever and dysentery, which occur chiefly between January and April, when dew falls and the nights are chilly, and being succeeded by warm days, care is necessary to guard against changes of temperature.

Plan 815 of the harbour and bays of Trincomalí.

COAST.—From Chapel point the coast turns abruptly to the northward for about 2 miles, to the conspicuous headland of Fort Frederick, which terminates, to the northward, in Flagstaff point. Rocky point, which divides the space between, is the north-eastern termination of Ostenberg ridge.

Depths off-shore.—Northward of Trincomalí the 100-fathoms contour line gradually recedes from the coast, until, north-eastward of Point Pedro, it is about 30 miles distant.

Chapel point (*Lat. 8° 33′ N., Long. 81° 15 ′E.*) is rocky with a rounded base, behind which the slopes of Chapel hill rise steeply.

Chapel rock, 3¾ cables east-north-eastward of Chapel point, is 3 feet high, and close inside the 5-fathoms contour line; a narrow rocky bridge, with 1½ fathoms water over it, extends about 1½ cables north-eastward of the rock, and the water then deepens suddenly to 8 and 12 fathoms.

Clearing mark.—A detached rock off Flagstaff point, in line with Elizabeth point, bearing about N. 22° W., leads eastward of Chapel rock and of the shoal water off Rocky point.

Rocky point, narrow and cliffy, tails out to seaward for a distance of 3 cables in a north-east direction, in a series of remarkable knife-edged rocks, among which stands a rocky pillar, 65 feet high, and conspicuous from the northward or southward.

The rocks, forming the point, gradually diminish in height, and the outer ones are only from 2 to 3 feet above water; they end in a shoal ridge half a cable outside the outermost rock, and from that drop down to depths of 7 and to 11 fathoms further out.

Two small shallow coves, full of rocky dangers, are formed in the intervening coast, and are divided by a cliffy point, sloping from a small hill, 150 feet high, which stands in the valley between Elephant and Ostenberg ridges.

General charts 2031, 828, 70.

Plan 815, Harbour and bays of Trincomalí. Var. 0° 40′ W.

Dutch point, with a cliffy and rocky sea face, is 75 feet high, or 110 feet to the tops of the trees, amongst which is the residence of the Assistant Government Agent, but it is partly hidden by foliage.

FORT FREDERICK.—Flagstaff point (*Lat. 8° 34′ N., Long. 81° 15′ E.*) is the northern extreme of Fort Frederick, a triangular promontory of bold aspect, and formed, on its eastern side, by black, perpendicular cliffs, which gradually diminish in height from Flagstaff point, where they are 30 feet high, to the south-east corner, where they reach sea level in a rocky point.

The top of the headland slopes with the cliffs, thus presenting a wedge-shaped appearance to the whole promontory as seen from the northward or southward. The summit, 1½ cables from its northern point, is 170 feet high, and on it a large, white signal flagstaff, surmounting a building. A large detached rock, with perpendicular sides and a flat top, lies close off the north end of Flagstaff point.

The Maidan, already mentioned, is the south-western termination of Fort Frederick, and here is a fortification wall, 50 feet high, with bastions at each angle and the remains of a moat; the white-painted gateway of the fort, on the southern face, is conspicuous from that side, but a sally port, on the northern side, near the sea, is not so easily recognised.

Fort Frederick, a War Office reserve, is entirely occupied by the Military, the barracks and other buildings, including a church, standing within the enclosure; the officer's mess, a large white building near the sea on the southern front, is very conspicuous from that direction, but other buildings in the fort, being mostly low, and obscured by trees, are not readily distinguished.

Dutch bay.—Between Dutch point and Fort Frederick the shore is low and sandy, the flat land, on which the southern part of Trincomalí town is built, stretching back to that harbour.

Three conspicuous objects may be seen from seaward, the first the Government hospital, a low, long building situated close to the shore, at the southern end of the bay under Dutch point. The second is the dome of the Roman Catholic chapel, painted white, showing above the trees at about a cable from the beach, and the third, further north, is a house known as the Naval Commissioners house, which is large, flat-topped, painted white, with two storeys, has a pillared verandah, and stands in a garden, amongst trees, about half a cable from the shore.

Anchorage.—During the height of the South-west monsoon Dutch bay will be found a more convenient anchorage for boat work than Trincomalí harbour, as there is an excellent lee, good landing anywhere along the shore, and as a rule no swell; it is also nearer to the European part of the town.

General charts 2031, 828, 70.

The best anchorage in the bay is in a depth of 6½ fathoms, over sandy bottom, with the hospital bearing S.W. ⅝ W.; the dome of the Roman Catholic cathedral W. ½ N., and Pra Malai N.W. by N.

Landing.—The northern part of Dutch bay, near Fort Frederick, is shoal and rocky, and there is a small rocky islet, named Pra Malai, at a distance of half a cable off-shore, behind which is the best landing place when there is any swell.

Back bay.—The north-western side of Fort Frederick has a rocky shore, with steep wooded and grassy slopes above, but it is not cliffy; from the southern end there is a smooth sweep of sand, in a north-north-west direction for about 2½ miles, which curves to the north-eastward to Elizabeth point and forms the shore line of Back bay. With the exception of a reef of rocks, one of which is 2 feet above water, and surrounded by foul ground for a short distance, the bay appears to be clear of dangers.

Bazaar rock (*Lat. 8° 35′ N., Long. 81° 14′ E.*), 2 feet high, is situated on the reef just mentioned, which extends for a distance of 3 cables in a north-east direction from the shore, about one mile from Fort Frederick, with a patch of foul ground to the northward.

Back bay is largely used by native craft, during the South-west monsoon, at which period the Custom-house, a conspicuous white building, is open; it is the only prominent object along this shore, which, so far as Red bluff, is low and fringed with cocoanut trees, backed by a range of wooded hills, from 140 to 208 feet high, but with no remarkable summit.

Red bluff, two patches of bare earth cliff, 46 feet high, and crowned by jungle, has on its southern side the entrance to a creek leading to Pullai Kulam Aru, a large but shallow salt water lagoon, which extends inland for about a mile westward, and the same distance southward.

Landing.—Fairly good landing may be effected at the mouth of the creek, when the surf of the North-east monsoon is not too high; during the South-west monsoon, landing may be easily effected anywhere in the bay.

Klahati Paar, a patch of 14 fathoms, 5½ cables north-eastward of Flagstaff point, is a favourite fishing ground with the natives for the fish from which the shoal takes its name.

Two patches of 5½ fathoms, lying east and west from each other, are situated 2¾ and 4¼ cables north-westward of Flagstaff point, and are surrounded by depths of from 6 to 8 fathoms.

Fish shoal (Heroine rock), with a depth of 4¾ fathoms over, and 6 fathoms round it, and lying 6¾ cables east-north-east from Red bluff, is a favourite fishing ground for the natives of Challitivu

Plan 815, Harbour and bays of Trincomali. Var. 0° 40′ W.

village, which is situated between Red bluff and Elizabeth point, but though near the beach is obscured by trees.

Anchorage.—Vessels may anchor anywhere in Back bay during the South-west monsoon, but in the North-east monsoon it is dangerous. The most convenient berth is in 7½ fathoms water, over sandy bottom, with the detached rock, off Flagstaff point, bearing S.E. ¼ S., and the dome of the Roman Catholic chapel, S. ⅝ W.

Elizabeth point (*Lat. 8° 38′ N., Long. 81° 13′ E.*) is low and not easily distinguished; the land behind it, very slightly elevated, is wooded and fronted by cocoanut trees, and a large conspicuous tree standing above the others, is 2½ cables westward of the point. Several large rocky boulders at the point are continued for a short distance to the northward.

From 4 cables southward of the point, a fringing coral reef commences and extends a cable from the coast and the point, and for a distance of 6 cables northward of the latter patches of coral and rocky reefs, lie off-shore.

Lively rocks, two of which are always above water, and another that is nearly always breaking, are the termination of shoal and foul ground which stretches to the eastward from Elizabeth point; one of the rocks is 3 feet high, and close outside them there are depths of 5 and 6 fathoms.

Another group of boulders, one foot high, are on the reef 4 cables northward of Elizabeth point.

Malai Porru Putta Paar, with 2¼ fathoms water over it, lies 1$\frac{1}{10}$ miles north-eastward of Elizabeth point; being small, surrounded by depths of from 7 to 9 fathoms, and not showing in any way, it is dangerous.

Clearing mark.—The eastern extreme of Fort Frederick in line with the eastern side of Chapel island, bearing South, leads a quarter of a mile eastward of the rock, in a depth of 10 fathoms.

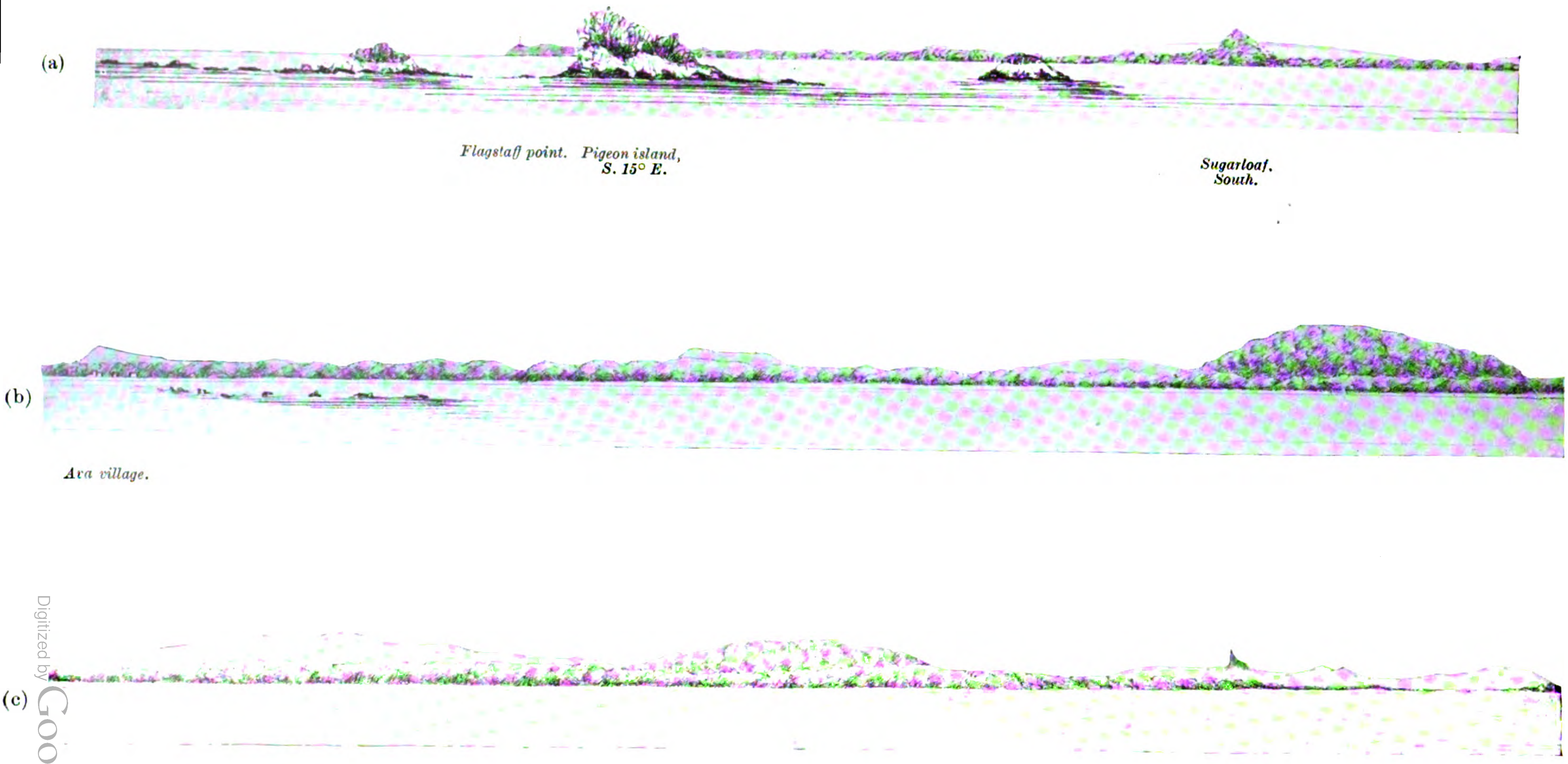
Chart of Ceylon, 2031, from Lat. 7° 20′ N. to Point Pedro.

COAST.—From Elizabeth point the coast has a northerly direction for one mile, and then turns to the westward giving the appearance, from the southward, of a sharply defined, low flat point; the sandy beach, fringed by a reef extending a cable off, is backed by low and flat land, which in 1907 was freshly planted with cocoanut trees.

Nilavelli village, near the coast, about 3¾ miles north-westward of Elizabeth point produces a considerable quantity of salt.

Rocks.—Fairlie rock and Diomede rock, both under water, are charted 2¼ and 4 miles respectively northward of Elizabeth point, and

To face page 175.]


(a)
Flagstaff point.
Pigeon island, S. 15° E.
Sugarloaf, South.
(b)
Ava village.
(c)
Pinnacle hill, N. 77° W.

View of the land southward and northward of Ava point.

one mile and 1½ miles off-shore. The positions of these rocks is very doubtful, and possibly there is only one rock.

Pigeon island (*Lat. 8° 44′ N., Long. 81° 12′ E.*), 99 feet high, and 8¾ miles north-north-west of Flagstaff point, is rocky, with a few shrubs on it. (View *a*, page 175.)

Directions.—When off the coast between Back bay and Pigeon island, Flagstaff point should not be brought to bear eastward of South, to avoid the rocks and foul ground off it, and Pigeon island should not be approached to a nearer distance than 2 miles.

At night or in thick weather vessels should not shoal to a less depth than 25 fathoms.

COAST.—Andamban Malai, a hill 381 feet high, is situated 7 miles west-north-westward of Pigeon island; Pinnacle hill, or Naga Malai, about 150 feet high, with a sharp finger-like peak, is about a mile north-eastward of Andamban Malai. (View *c*, page 175.)

Boulder point, which protrudes slightly, is about 11½ miles north-westward of Pigeon island, and Kettimangare or Red Cross river flows into the bay westward of the point; at 9 miles north-westward of it is the entrance of Lake Kokelé; 8½ miles further north-westward, near Black point, are some conspicuous red cliffs 120 feet high. Between Boulder point and Muletivu village, a distance of 29 miles, the coast shows a fringe of trees of uniform height without hills, and has few distinguishing features.

Muletivu.—At Muletivu a bungalow with a red roof, situated in the village, near the beach, and a building with a white cross, about half a mile to the northward, are conspicuous from the offing.

LIGHT.—On the southern entrance point of Vattuvakal Aru, northward of Muletivu, an iron lattice-work obelisk, 77 feet in height, with a dome top, exhibits, at an elevation of 79 feet above high water, a *white fixed* light, which should be seen from a distance of 12 miles in clear weather.

Supplies of bread and vegetables may be procured; the water is from wells.

MULETIVU SHOALS, extending about 3½ miles eastward and 5½ miles northward from the coast at Muletivu, are 8½ miles in length in a north and south direction, within the 5-fathoms contour line; the depths in the southern portion vary from one fathom to 4½ fathoms, and the northern part consists of knolls with depths from 2 fathoms to 4½ fathoms over them.

The 10-fathoms contour line is about three-quarters of a mile eastward of the shoals. The sea breaks heavily on the northern side of the shoals in the North-east monsoon. From 6 to 8½ miles northward of Muletivu shoals are patches of from 4 to 5 fathoms, the northern, with 4½ fathoms, being 5 miles off-shore.

General charts 829, 70.

Chart 2031, Ceylon, east coast. Var. 0° 30′ W.

Directions.—Between Pigeon island and Muletivu, vessels should not shoal the water to less than 20 fathoms by day or 25 fathoms at night, nor pass Muletivu shoals in less depth than 20 fathoms.

COAST.—Between Vattuvakal Aru entrance and Point Pedro the coast trends north-westward for 47 miles, and is low throughout. At about 17 miles from Vattuvakal Aru the waters of a lagoon find an exit at high water; this lagoon extends westward into Palk bay, and the northern part of the island is a peninsula named Jafna. *See* page 189.

Obelisk (*Lat.* 9° 34′ *N., Long.* 80° 28′ *E.*).—An obelisk, 50 feet high, and painted white, is situated on the coast about 25¼ miles north-westward of Vattuvakal aru entrance.

POINT PEDRO SHOAL, with depths of from 2 to 4 fathoms over it, stretches north-westward at distances of from 2 to 8 miles off the land; the south-eastern end of the 5-fathoms contour line of the shoal being 5 miles east-north-east of the obelisk. The shoalest patch, named Ethiopia shoal, with a depth of 2 fathoms over it, lies at the in-shore elbow of Point Pedro shoal, 12 miles from its south-east end and 3¼ miles off-shore.

The whole shoal has been only partially examined, and must be approached with caution.

Between Point Pedro shoal and the coast is a channel 2 miles wide in its narrowest part, with depths of from 6 to 10 fathoms, over a bottom of soft mud.

Clearing mark.—The obelisk bearing about W. by S. should lead about one mile southward of the south-east extreme of the shoal.

Directions.—If passing outside or eastward of Point Pedro shoal, the land northward of Muletivu shoals should not be approached within a depth of 20 fathoms; Point Pedro shoal may apparently be approached to a depth of 10 fathoms, but, as already mentioned, caution must be used.

To pass between Point Pedro shoal and the main island, the coast northward of Muletivu shoal should not be approached nearer than a depth of 10 fathoms, until about on the parallel of the white obelisk, when it should be used as a guide for clearing the southern end of Point Pedro shoal, and on entering the channel inside that shoal, keep about 1½ miles off-shore.

Anchorage.—In case of baffling wind, or at night, there is good anchorage, if necessary, in any part of the channel, but in a sailing vessel, if working in it, do not borrow on Point Pedro shoal, as there may be less water on it than is shown on the chart.

POINT PEDRO LIGHT, *red fixed*, visible 7 miles. *See* page 196.

General charts 829, 70.

CHAPTER III.

PAMBAN PASS, PALK BAY AND STRAIT, TO CALIMERE POINT AND POINT PEDRO.

(*Lat. 8° 57′ N. to lat. 10° 18′ E.*)
(*Long. 78° 53′ E. to long. 80° 14′ E.*)

VARIATION: Nearly stationary.

Chart 68a, Palk strait and Gulf of Manár. Var. 0° 40′ W.

MANÁR ISLAND, which is separated from Ceylon by a boat channel, is about 15 miles in length in a north-west direction, and 3½ miles in greatest breadth. For about 5 miles from its south-east end, on the south-west side, the island has low sandhills, and at the west end are numerous cocoanut and other palms near the villages. The baobab, the trunk of which sometimes attains a diameter of 30 feet, grows on the island, but its height is by no means in proportion to its girth.

Manár port (*Lat. 8° 58′ N., Long. 79° 55′ E.*), near the south-east end of Manár island, and on the north side of the boat channel separating Manár island from Ceylon, affords shelter to small vessels; it has a south bar and a north bar, at each of which Custom-house officials examine vessels entering.

Town.—The town of Manár, with a population of about 3,000, is surrounded by cocoanut trees, and lies at the head of the port.

Pesalai, a small port on the north-east side of Manár island, affords good shelter during the South-west monsoon.

Talamanaar, at the west end of Manár island, is proposed as the terminus of a branch railway from Madamachchiya on the main line from Colombo, and piers will be built to accommodate the steamers connecting with the railway under construction to Mandapan and Madura, *viâ* the Pamban pass.

ADAM'S BRIDGE, a narrow ridge of sand and rocks, mostly dry, connecting Pamban and Manár islands, is about 15½ miles in length, 1½ miles in width, and is mostly composed of shifting sandbanks, with intricate channels between them, in which the average depths vary, and may be about 3 or 4 feet at low water. In the South-west monsoon a strong current sets northward over Adam's bridge; a

General charts 828, 70.

Chart 68a, Palk strait and Gulf of Manár.

confused sea, which weakens to the westward as the Indian coast is approached, is generally experienced near Manár island.

The edge of the bank to the 100-fathoms contour line is about 12 miles south-westward of Adam's bridge.

Adam's bridge divides the colony of Ceylon from the Indian Empire.

PAMBAN ISLAND, about 15½ miles in length, in a north-west and opposite direction, and lying between Adam's bridge and Ramen point, of Madura, is low, sandy, and well planted with cocoanut trees towards the western end, where a broad peninsula extends to the northward, making the island about 4½ miles in breadth at that part.

Chuttram, about 2 miles from the south-east end of the island, is situated on the south-west coast, amongst a clump of palm trees, about 75 feet high, and is easily recognised.

Light.—A *white fixed* is exhibited, at an elevation of 75 feet above high water, from a mast 45 feet in height at Chuttram, and should be visible in clear weather from a distance of 8 miles; it is intended as a guide to vessels making Pamban port.

Rameswaram town, with a population of 6,632 in 1901, is situated on the south-eastward side of the broad peninsula already mentioned, and that of Pamban is at the western end of the island.

Plan 3581, Approaches to Pamban pass.

Peruvadum temple, with towers 120 feet in height, stands on rising ground, on the north part of the island, in an enclosure 1,000 feet long and 650 feet broad, which is entered by a gateway 100 feet high; it is situated about 5 miles eastward of Pamban lighthouse, and is visited by large numbers of pilgrims from India. Southward of the temple is a fresh-water lake, about 3 miles in circumference.

Plan 69, Pamban pass. Var. 0° 40′ W.

Kundagal point (*Lat. 9° 15′ N., Long. 79° 13′ E.*), the south-western point of Pamban island, is low and sandy, but cocoanut plantations commence a short distance from it, and extend northward and north-eastward. Eastward of Kundagal point the coast is backed by low sandhills covered with scrub and stunted bushes.

Beacons.—A beacon stands about half a cable within the point; East port beacon, painted white, is nearly 2 miles eastward of it and a boundary pillar is situated half a mile east-south-east of East port beacon. *See sketches of beacons on 69.*

Plan 3581.

Shingle islets, two small low islets 1¼ miles south-eastward of Kundagal point, with a few bushes and shrubs on them, stand on

Plan 3581, Approaches to Pamban pass. Var. 0° 40′ W.

Kallarú reef, a coral formation, on the south-western sides of which the sea breaks heavily; the reef extends nearly one cable eastward, 3½ cables westward, and nearly 2 cables northward of the islets. Patches of 17 and 18 feet lie from 8½ cables to 1$\frac{4}{10}$ miles eastward of Shingle islet beacon.

Beacon.—A large triangular beacon, 40 feet in height, and painted white with a black band in the centre, stands on the eastern islet. *See sketch of beacon on 69.*

Chart 68a.

OUTER DANGERS IN THE APPROACH TO PAMBAN PASS.

OUTER DANGERS IN THE APPROACH TO PAMBAN PASS.—The 10-fathoms contour line, southward of Pamban island, is very irregular, but generally extends about 10 miles from the south coast of that island, and inside it are several dangers.

Margarita shoal, about 2½ miles in length, in an east and west direction, and three-quarters of a mile in breadth, with a least depth of 1¾ fathoms over it, lies close to the 5-fathoms contour line, its southern edge being about 3½ miles south-westward of Lands End, the south-east point of Pamban island.

Detached shoals, with depths of from 2¾ to 3 fathoms over them, extend for a distance of 6½ miles in a south-east direction from the east end of Margarita shoal along the south-west side of Adam's Bridge, and a 5½-fathoms patch is situated just inside the 10-fathoms contour line, 3½ miles south of the shoal.

Chart 3581, Approaches to Pamban pass

Arundel shoal (*Lat. 9° 7′ N., Long. 79° 16′ E.*), three patches with a least depth of 28 feet over them, is situated about 6 miles westward of Margarita shoal, and about 1½ miles within the 10-fathoms contour line; a patch of 28 feet lies 3¼ miles west-north-west of Arundel shoal.

Mansfield patch, the northern of several patches extending nearly 1½ miles in a north and south direction, has a least depth of 19 feet over it, and lies about 2½ miles north-north-east of Arundel shoal.

Batt patch, with 16 feet least water over it, extends in a series of detached patches for a distance of nearly 3 miles, in an east-south-east and opposite direction, and is about 3¼ miles north-north-west of Arundel shoal, and 5 miles from the south coast of Pamban island; the sea breaks on it in a fresh breeze.

Clearing mark.—East Port beacon, just open eastward of Shingle islets beacon, bearing N. 32° E., leads westward of Batt patch.

General charts 68a, 828, 70.

Chart 3581, Approaches to Pamban pass. Var. 0° 40′ W.

Kurisadi, Pullivausel, and Pulli, three low islands, covered with scrub and bushes, which lie south-westward of Kundagal point and of Horse-shoe bank, are completely encircled by Pulli reef, composed of coral, drying at low water, spring tides, the whole forming a breakwater that protects Pamban pass and the channels leading to it from the swell of the South-west monsoon. The northern edge of the reef is clearly defined at low water, but its southern edge is much broken into patches, and the sea breaks over it.

The ruins of a hospital and a well are situated near the east end of Kurisadi island.

The passage between Kallaru reef and Kurisadi island has a rock with 9 feet water over it in mid-channel, and is seldom used, the bottom being foul and uneven, and occasionally heavy breakers extend across it.

Plan 69, Pamban pass.

Beacons.—A beacon, 30 feet in height, and known as Kurisadi beacon No. 2, is situated about 4 cables westward of the east end of Kurisadi island; and Pulli beacon, a similar height, and painted white, stands on the south-west side of Pulli island.

The following beacons mark the northern edge of Pulli reef:—Kurisadi beacon No. 1, north-west of Kurisadi beacon No. 2; a beacon northward of Pulli island; and one on the angle of the reef nearly midway between the two preceding ones. *See sketches of beacons on 69.*

Kundagal channel and gut are the passages formed between the south side of Pamban island, on the north, and Kallaru and Pulli reefs, on the south; the former is about 4 cables wide at its entrance, northward of Kallaru reef, and the navigable width of the latter is about 3 cables between Kundagal point and Kurisadi island.

Anchorage.—The space between the eastern side of the northern edge of Pulli reef and the south-west side of Pamban island forms a sheltered anchorage for vessels of light draught in all weathers.

Chart 3581.

Pulli shoal, the south-west extreme of which lies about 1¾ miles southward of Pulli beacon, whence it extends east-north-eastward nearly to Pulli reef, is composed of sand and coral; the general depths on it are from 8 to 12 feet, but on its north-western part is a rocky patch with only 5 feet over it. With a moderate breeze the sea breaks on the shoal.

Chart 68a.

Manauli islet (*Lat. 9° 13′ N., Long. 79° 8′ E.*) is situated 6 miles west-south-west of Kundugal point, the south-west extreme

General charts 68a, 828, 70.

Chart 68a, Palk strait and Gulf of Manár. Var. 0° 40′ W.

of Pamban island, and lies on the north side of a reef, nearly 8 miles long in an east-north-east and opposite direction; Musel island nearly 2 miles in length is on the same reef near its western end.

From Manauli islet a number of islets, fringed with reefs, and with banks intervening, extend westward at some distance off the coast of Madura between Toniturei and Tuticorin, and shelter a considerable extent of the northern part of the Gulf of Manár from the swell of the South-west monsoon, where there is smooth water navigation for coasting craft.

At from 1¼ to 2 miles southward of the reef encircling Manauli and Musel islets, are several shoals with 2 to 3 fathoms water over them.

Manauli shoal, the shoalest of these patches, with 12 feet least water over it, lies 2⅔ miles southward from Manauli islet; only the eastern part of this shoal has been examined.

Beacon.—A beacon, 15 feet high, and painted white, marks the east extreme of a shoal which extends about 1½ cables eastward of Manauli point, the east extreme of Manauli islet.

Chart 3581, Approaches to Pamban pass.

Manauli reef, the eastern end of the reef surrounding Manauli and Musel islets, extends 2 miles eastward of the beacon, is about 9 cables broad, and consists of coral, drying at low water, spring tides.

Puma channel, between the shoal extending westward from Pulli shoal and that extending eastward from Manauli reef, is 4 cables wide, and within it is Puma East channel, between Pulli reef and Horse Shoe bank, to be referred to hereafter.

INNER DANGERS.—Cana Paru reef, 1$\frac{2}{10}$ miles westward of the south-west extreme of Pulli island, is a coral patch which dries about one foot at low water, and is surrounded by depths of from 12 to 16 feet.

Kolimuruka reef; awash at low water, lies about 7 cables west-south-west of Cana Paru reef, and nearly the same distance from the northern edge of Manauli reef.

Heron reef, 9 cables westward of Cana Paru, is awash at low water.

May reef (*Lat. 9° 1¼′ N., Long. 79° 8′ E.*), about 4 cables north-eastward of Heron reef, is of small extent, and awash at low water.

Sunken reef lies 1½ miles north-westward of Cana Paru reef; there are other shoal spots, best seen by referring to the plan.

Post.—Sunken reef is marked by a post.

Plan 69, Pamban pass.

Horseshoe bank, southward of Pamban pass, is an extensive sandbank, which projects south-westward from the west end of Pamban island, and bends round in the form of a horseshoe to Ramen point;

General charts 68a, 828, 70.

Plan 69, Pamban pass. Var. 0° 40′ W.

the general depths over it are from 2 to 6 feet, and at about 7½ cables south-south-westward of Mundel point, the southern point of the western end of Pamban island, Sandbank channel has been dredged through the bank to the depth of about 11 feet at low water.

PAMBAN PASS, the channel between the western end of Pamban island and Ramen point; it is of great advantage to native craft trading between the west coast of India and Manár gulf, and the east coast of the peninsula and Burmese ports. It is also used by the coasting steamers of the British India Steam Navigation, and the Ceylon Steamship Companies, which vessels are of from 200 to 800 tons, about 200 feet in length, and quite as large as can be safely navigated in the pass.

The principal rocky barrier through which the pass has been made extends in a nearly straight line from Pamban to Ramen point, and the northern part of the pass, through this rocky reef, is 4,232 feet in length with a width of 80 feet; the southern part, known as Kelkari passage, is 2,100 feet in length and 150 feet in width.

The portion eastward of Pamban pass is a ledge of rocks, evidently once connected with and part of the Great dam; it is covered at high water, and there are several patches of rock southward of it with varying depths of water between.

The part on the west side of the pass, named the Great dam, consists of large masses of rock having a flat surface, portions of a causeway that formerly extended from Pamban island to the mainland. At 1½ cables from Ramen point a small opening in the rocks exists, but even fishing canoes never attempt to use it, owing to it being so narrow and the rush of water through it.

The northern face of the dam at low water is steep-to, and presents a wall-like appearance, but the boulders are sufficiently separated to allow a free passage to the water at low tide.

At about 100 yards southward of the Great dam, and parallel to it, is another rocky ridge termed the South dam, which shows partially at low water and extends half way from the pass to Ramen point.

LIGHT (*Lat. 9° 17′ N., Long. 79° 13′ E.*).—A cylindrical column, 67 feet in height, situated on a sandhill on the north-west point of Pamban island and 7 cables eastward of Pamban pass, exhibits, at an elevation of 97 feet above high water, a *white group occulting* light, with a period of system of *one minute*, showing four eclipses, thus:—light, *twenty-one seconds;* eclipse, *four and a half seconds;* light, *seven seconds;* eclipse, *four and a half seconds;* light, *seven seconds;* eclipse, *four and a half seconds;* light, *seven seconds;* eclipse, *four and a half seconds;* it should be visible, in clear weather, from a distance of 14 miles.

General charts 68a, 828, 70.

Plan 69, Pamban pass. Var. 0° 40′ W.

Storm signals are shown. *See* pages 74-76.

Kanthe Thuki reef, 2 to 2⅔ cables westward of Pamban lighthouse, is composed principally of coral patches, which partially dry at low water. There is a boat channel between the reef and the shore, used by pilots when boarding vessels in the North-east monsoon.

Toniturei, a narrow tongue of land projecting eastward from the coast of Madura (India) terminates in Ramen point, which is rather more than one mile westward of Pamban town. Toniturei temple and the cable-house are about a cable inside the point, and about the same distance further westward is a conspicuous clump of cocoanut palms, 53 feet in height.

Mandapam, a small village rapidly growing in importance, is situated 2½ miles westward of Toniturei.

Communication.—A branch of the Southern Indian railway connects Mandapam with Madura, and thus with the Indian system. (Page 197.)

Coal.—Indian coal can be obtained at Mandapam from the South Indian Railway Company.

Kathu Vallimuni reef, lying immediately off the north side of Toniturei, is 1⅔ miles in length in an east and west direction, and 3½ cables in greatest breadth: it consists principally of large patches of coral and rock, with several feet of water between them, and partially dries at low water, spring tides. There is a boat channel about half a cable broad between this reef and the main.

SOUTHERN APPROACH.—The pass is approached from the southward, through Kundagal channel and gut, and thence by Sandbank channel and The Basin, a distance of about 3¼ miles from a position northward of Kallaru reef.

There is also an approach entering by Puma channel between Pulli shoal and Manauli reef; thence through Puma East channel and between Pulli reef and Horseshoe bank, joining Sandbank channel. The pass, between the rocky ledge extending westward from Gibbs monument, situated 66 cables south-westward of the lighthouse, and the east end of the Great dam, is about 6 cables in length, the narrowest part being the channel, 80 feet wide, through the Great dam; the pass shoals suddenly on both sides.

Depths.—From Kundagal channel, where the depths are from 19 to 23 feet, the water shoals to about 12 feet in Kundagal gut, and in Sandbank channel, on the line of the leading beacons, the least depth is 10 feet, but this line leads very close, on the southern side, to Horseshoe bank.

General charts 68a, 828, 70.

Plan 69, Pamban pass. Var. 0° 40′ W.

Through the Basin the depths are from 15 to 21 feet, shoaling at its northern end and the southern entrance to the Kelkari passage, which is dredged to a depth of 12 feet, the opening between the rocky ledge and the Great dam being dredged to 14 feet. The greatest draught of vessels navigating it is 11½ feet, although at the top of exceptionally high tides, and in calm weather, steamers drawing 12 feet have been taken through.

Beacons and buoys.—The beacons on and near the south-west point of Pamban island, and also those marking the islets and dangers off it, have been already described; those and the buoys marking the channels leading to, and in, the pass will now be mentioned.

Rock beacon (*Lat. 9° 15′ N., Long. 79° 12′ E.*) is situated about a third of a mile southward of the entrance to Sandbank channel, and is the inner beacon of the western entrance to Puma East channel.

Beacons stand on the points of Horseshoe bank on each side of the entrance to Sandbank channel, and both sides of the Basin, and Pamban pass, are marked by beacons, the positions of which are best seen on the plan.

A chequered conical buoy, surmounted by a staff and sphere, is moored about 2 cables south-westward of the entrance to Sandbank channel.

The Elbow buoy, conical, and painted red, marks the elbow of the eastern portion of Horseshoe bank, at the turning point to the Basin.

A can buoy, painted black, is moored on the eastern side of the pass, about 2 cables northward of the beacon on the west extreme of the rocky ridge extending from Gibbs monument.

The outer buoy on the northern side of the pass is a can buoy, painted in chequers, situated rather more than half a mile north-north-eastward of the western extreme of the rocky ledge.

In Puma East channel, the beacons on the northern edge of Pulli reef mark the southern side, and a beacon 4 cables westward of the north point of Pulli island, with another on the south-west point of Horseshoe bank, mark the northern side of that channel.

Pilots.—Pilotage is compulsory, and the licensed pilots of Pamban are under the orders of the Master attendant. During the South-west monsoon pilots are stationed on Pulli island, to look out for vessels making Pamban from the southward; the canoes fly a small red flag with the pilot's number.

Anchorage.—There is fair anchorage anywhere northward of the southern reef over a bottom of dead coral and sand.

General charts 68a, 828, 70.

Plan 69, Pamban pass. Var. 0° 40′ W.

Anchorage (*Lat. 9° 15′ N., Long. 79° 13′ E.*) may be obtained in Kundagal channel in depths of from 19 to 23 feet, with the beacon on Shingle islet bearing between South and S.E., or southward of Kundagal point, in a depth of 18 feet, with the beacon on that point bearing about N. by E. ¾ E., distant 2 cables.

There is also anchorage northward of the pass in from 20 to 23 feet water, over mud bottom and very good holding ground, with the lighthouse bearing between S.E. and S.E. by E. ⅛ E., distant about one mile, and Toniturei temple S.W.

Charts 69, 3581.

Directions.—Caution is necessary in approaching Pamban from the southward, as the islands fringing the coast are very low, and there are no conspicuous marks; during the South-west monsoon a thick haze frequently hangs over and obscures the islands.

The tower of Peruvadam temple, and Chuttram palm trees should be among the first objects recognised, and perhaps Pamban lighthouse and the beacons on Kurisadi, Pulli, and Manauli islands and on Shingle islet.

Vessels of more than 15 feet draught should not shoal the water to less than 8 fathoms until the position is ascertained by bearings of objects.

Kundagal channel, which is the best entrance, should be approached with Peruvadam temple bearing N. ½ W., to pass eastward of Mansfield patch, until Shingle islet beacon bears N.W. ¼ N., when it may be steered for, or with Pamban lighthouse just open eastward of Shingle islet beacon, bearing N. 24° W., which leads between Mansfield patch, on the east, and Arundel shoal and Batt patch, on the west, or, if more to the westward, East Port beacon just open eastward of Shingle islet beacon, bearing N. 32° E., leads westward of Batt patch.

When East Port beacon bears N. by E. ¼ E. it may be steered for, passing between Kallaru reef and the patches, on which the least depth is 17 feet, to the eastward of it. Kundagal beacon should be steered for bearing W. by N. ½ N., and mid-channel kept through Kundagal gut, anchoring south-south-west of Kundagal point, as already directed.

Plan 69.

If intending to proceed through Pamban pass, from a position midway between Kundagal point and Kurisadi island steer about W. by N. ¾ N. for the chequered buoy, and to bring Kurisadi beacons, Nos. 1 and 2, in line bearing S. 49° E., which, used as a stern mark, leads through Sandbank channel, afterward rounding the beacon and red buoy which mark the south-west elbow of Horseshoe bank,

General charts 68a, 828, 70.

Plan 69, Pamban pass. Var. 0° 40′ W.

and proceed up the Basin steering about N.N.E. ½ E., and the plan and beacons will then be a guide through the pass to the Outer chequered buoy.

Coming from the westward, with East Port beacon open eastward of Shingle islet beacon, bearing N. 32° E., when Pulli beacon bears N.W. steer N.E. till East Port beacon bears N. by E. ¼ E., and then proceed as above.

Chart 3581.

Puma channel (*Lat. 9° 13′ N., Long. 79° 10′ W.*), between the shoal water extending westward of Pulli shoal and Manauli reef, should be navigated principally by the eye, as Manauli reef is clearly visible, with deep water one cable off it all round, and the sea always breaks on its southern and eastern sides.

Pass about 2 cables eastward of Manauli reef, and then 2½ cables westward of Pulli reef, and as soon as Kundagal point beacon is in line with the north point of Pulli island, bearing N. 77° E., the beacon northward of Pulli island will be a guide for turning into Puma East channel, avoiding the 8-foot patch nearly 4 cables westward of it, and marked by a beacon. Having passed between the beacons at the eastern end of the channel, steer to bring Kurisadi beacons in line as a stern mark, and proceed as previously directed.

In approaching Puma channel from the eastward, do not shoal to less than 4 fathoms, so as to avoid Pulli shoal and the reef which extends about half a mile southward of Pullivausel.

From the westward and passing between the islets and the southern coast of Madura, when abreast Manauli islet, look out for Kolimuruka and Cana paru reefs, and steer in about mid-channel between them and Manauli reef. These reefs all show well, and have deep water close-to.

From the northward the approach to Pamban pass is clear; the land in its vicinity is low, but Peruvadam temple on Pamban island, is a good guide from a distance; nearer the entrance, the lighthouse forms an excellent mark. Having made the outer buoy (chequered), steer to pass between the beacons which mark the channel.

At night approach the pass, with Pamban light, bearing between S.W. and S.S.E. ¼ E. During the strength of the North-east monsoon, owing to the short choppy sea which then prevails, it is unsafe to anchor northward of the pass, and the pass should not be neared at night.

Plan 69.

Tides.—It is high water, full and change, at Pamban, at 1h. 48m.; springs rise 3 feet, neaps rise 2 feet. During neaps, sometimes for 48 hours, there is a range of only one inch or 2 inches.

General charts 68a, 828, 70.

Plan 69, Pamban pass. Var. 0° 40′ W.

The tides are subject to a large diurnal inequality, which may accelerate or retard the times of high and low water, sometimes to the amount of one hour or more, and increase or diminish the rise by upwards of one foot; the rise and fall are also affected by the winds. During the North-east monsoon there is less water on the southern side of the pass than on its northern side, but in the South-west monsoon the reverse takes place, and the height of the water varies according to the force and continuance of the prevailing winds.

Tidal streams.—The flood stream enters between Kundagal point and Kurisadi island, and sets westward along the face of Pulli reef till it is joined by the stream setting in through Puma channel, when it takes a northerly direction, but is weak except during strong winds.

In Pamban pass a decided tidal stream is only noticeable in March, April, and October, when it generally sets for 6 hours each way.

Currents.—The currents at Pamban are generally influenced in strength by the force of the wind. Through the pass, the current frequently attains a rate of 5 to 6 knots, rendering it at times difficult to take even steam vessels through; during the North-east monsoon the current sets southward, and in the South-west monsoon northward.

PAMBAN TOWN (*Lat. 9° 17′ N., Long. 79° 12′ E.*), on the western part of Pamban island, and about a quarter of a mile southward of the lighthouse, consists principally of large huts and had 3,462 inhabitants in 1901; a superintendent of customs is stationed at Pamban, and the inhabitants are chiefly fishermen and boatmen.

It is proposed to make a new harbour at Dhanush Kodi, near Lands End, the extreme south-east point of the island, and to erect a pier, 1,800 feet in length, with a depth which will allow vessels of 26 feet draught to lie alongside.

Communication.—A steam vessel of the British India Steam Navigation Company runs to Negapatam and Colombo, generally weekly, and steamers of the Ceylon Steamship Company pass through every month, one going northward and another southward round the island. Pamban is connected by telegraph.

An arched viaduct, 1½ miles in length, of masonry, is in course of construction across the Pamban pass, and will connect Mandapam with Pamban island by a railway running over a swingbridge at the pass. A service of steamers will connect the island with Talmanaar, Manár island, and thence by a branch railway with Colombo.

Coal and supplies.—About 5,000 tons of Indian coal are kept in stock by the South Indian Railway Company, and about 10,000 tons

Plan 69, Pamban pass. Var. 0° 40′ W.

imported annually; there are 34 lighters, each of 10 tons, and about 500 tons could be put on board in 24 hours.

Supplies of fresh meat and bread can be procured; fresh water is of fair quality, and can be obtained in tank boats.

Trade.—Shipping.—The exports are unimportant, and consist of dried fish, salt, cocoanuts, palmyra, fibre, coral, for building purposes; the imports are rice, paddy, and other grain.

Hospital (*Lat. 9° 17′ N., Long. 79° 12′ E.*). — Seamen are admitted to the civil hospital.

Winds.—In October, south and south-west winds prevail and occasionally blow strong; towards the end of the month variable winds are experienced, which last till the early part of November, when the wind sets in steady from the northward and eastward, and generally blows strong for the remainder of the month. This wind continues during December, but it is then more northward, whilst heavy squalls of rain and wind are of constant occurrence.

During January and February, the north-east wind is light in the morning, but sets in strong about noon as a sea breeze, and falls again at sunset. (Page 62.)

March is fine at Pamban, the prevailing north-east wind being light; in the morning the easterly wind sets in, it shifts southward later, but by noon backs to east, in which direction it lasts till sunset, when it gradually fails; occasionally south and south-west winds blow for a day or two.

The wind in April is most uncertain, blowing from all quarters; squalls of wind and rain are experienced; the South-west monsoon occasionally sets in during this month.

Chart 68a, Palk strait and Gulf of Manár. Var. 0° 40′ W.

PALK BAY, formed on the east side by the northern part of the west coast of Ceylon, on the south by Manár island, Adam's bridge, and Pamban island, is about 40 miles in length in an east-south-east and opposite direction, and 23 miles in width between Pamban and Delft or Neduntivu island; it joins Palk strait at its north-western end, and is entered from the northward either between the north coast of Ceylon and South banks, or between Middle banks and Calimere point, other channels which are navigable being out of sight of land.

The general depths in the bay are from 6 to 7 fathoms, and on its eastern side the 5-fathoms contour line extends in places from the coast of Ceylon for a distance of about 15 miles, with several islands, rocks, and shoals, and no port or anchorage between Manár island and Kalumnai point, 33 miles to the northward. On the south side of the

Chart 68a, Palk strait and Gulf of Manár. Var. 0° 40′ W.

bay the 5-fathoms contour line is from 4 to 5 miles from the coast of the islands and from Adam's bridge, with a number of shoals inside it.

The bay has not been thoroughly examined.

Rocks awash lie about 1½ miles eastward of the north-east end of Pamban island, with shoal water extending a mile outside them, and the water should not be shoaled under a depth of 5 fathoms in this neighbourhood. Sailing vessels should avoid the bay eastward of Pamban island in the North-east monsoon, as it is difficult to work out of it.

The eastern side of Palk bay forms a considerable double bight between Manár island and Kalmunai point, almost the whole of which is shallow water, extensive banks of mud and sand, and some small islands.

Of these islands, Kakerativu, about 3 cables across, lies 20 miles northward of Manár island; and Palaitivu, about a mile in extent, is nearly 7 miles east-north-east of Kakerativu.

Beacons (*Lat. 9° 29′ N., Long. 79° 59′ E.*).—A beacon, 35 feet above high water and painted white, stands on Palaitivu, and on Kalmunai point is a beacon, 25 feet in height, painted white, and elevated 35 feet above high water.

Catchetivo, an islet about three-quarters of a mile across, lies 9¼ miles south-westward of the south-west side of Delft island; shoal water appears to extend nearly 1½ miles northward of it.

Chart 2197, Pedro point to Delft island.

JAFNA PENINSULA is generally low, formed of coral and sand, interspersed with salt-water lagoons and stony plains, and low coral cliffs and sandhills are occasionally visible from seaward; a good road traverses the peninsula. Several islands lie off its south-west side.

The soil of the peninsula is exceedingly prolific, and being populated chiefly by Tamils, a thrifty and industrious people, it has become, by scientific culture, the most fertile part of the island; although water is practically non-existent on the surface, the land is irrigated from numerous wells. Various kinds of vegetables are grown, and tobacco forms the chief crop; the population of the peninsula is about 300,000.

Lagoon.—Immediately northward of Kalmunai point, and between it and the coast at Jafnapatam, is the entrance to a shallow lagoon, about 3 miles wide at its mouth, which extends to Chandi Kulam, on the east coast, where a narrow strip of land joins the peninsula to the mainland.

JAFNAPATAM, about 4 miles north-westward of Kalmunai point, is situated on the northern side of a shallow inlet between Kalmunai point and Mandaitivu island, and is the principal town of the vicinity.

General charts 68a, 828, 70.

The port is approached from the south-eastward, but it is only available for vessels of small draught, as shoal ground, with depths of one fathom over it, lies in the approach, 1½ miles southward of the village; the chart is the best guide to it.

Obelisk.—An obelisk marks the western side of the southern entrance to the channel leading to Jafnapatam; depths of from 1¼ to 3 fathoms extend for 2¾ miles southward of the obelisk, but its exact position is uncertain.

Anchorage.—There is temporary anchorage in depths of from 4 to 4½ fathoms at a distance of 1½ miles south of the southern point of Mandaitivu, but this position is unsafe from the middle of May to the middle of August, when the South-west monsoon, from which there is no shelter in this vicinity, blows with great violence.

Town (*Lat. 9° 40′ N., Long. 79° 59′ E.*).—The town has a Custom-house, and there is a Master attendant, and special regulations are in force as to the hire of boats for landing or shipping cargo. The population of the town was 33,879 in 1901; the inhabitants are principally Tamils.

Communication.—There is a post and telegraph office, and a railway is under construction to Kankesanturai.

Supplies of fresh meat, bread, and vegetables may be procured, but no water.

Winds.—The North-east monsoon prevails at Jafnapatam from November to February, and the South-west monsoon from the middle of April to October. During March, and the first half of April, the prevailing winds are south-easterly.

MANDAITIVU, about 2¾ miles in length in a north-north-east and opposite direction, and 1¼ miles in width, is situated 3 miles westward of Kalmunai point, and is separated from Jafnapatam by a shallow channel, 1¾ miles wide, in which are some islets; the northern end is marshy, but on the south side are cocoanut palms.

Punkudutivu, an island separated from Mandaitivu by a shallow and foul bay about 6 miles in width, in the western part of which are pearl oyster beds, is nearly 5 miles in length in an east and west direction, and about 3 miles in breadth. It is planted with cocoanut palms, and from its northern side a bank of mud, dry in most places at low water, spring tides, extends about 1½ miles north-eastward.

Beacon.—On the south-eastern part of Punkudutivu island is a white stone beacon, 25 feet high, with its summit 35 feet above high water.

Nayinativu, the south-west island of the group, extending westward of Jafna peninsula, is 2¼ miles long in a north and south direction, and half a mile broad; it has trees about 70 feet in height on it, and is borderd on its western side by a narrow fringing reef. A flagstaff is situated on its south-east side.

A shoal about half a mile in length in a north and south direction, with a depth of 2¾ fathoms over it, lies about three-quarters of a mile off the western side of Nayinativu, and another shoal, with a depth of 3 fathoms, is about midway between it and the south-west point of the island.

Delft island (Neduntivu) (*Lat. 9° 30′ N., Long. 79° 40′ E.*). —South-westward of Nayinativu, and separated from it by Delft channel, about 4 miles broad, is Delft island, which is 6 miles in length in a north-west and south-east direction, with an average width of 3 miles; from a distance northward the island appears as two islands.

Palms, 70 to 80 feet in height, are on its north-eastern and western parts, while the southern is grass land with trees about 20 feet high, divided by loose stone walls; a shallow salt lake occupies the centre of the island. The Government have a pony-breeding establishment on Delft island.

The island is nearly steep-to, except on the northern side, where depths of under 5 fathoms extend for about 9½ miles to the north-north-eastward.

Beacon.—A beacon, 40 feet high, and painted white, used in the trigonometrical survey of India, is situated on the south-eastern coast of the island.

Neduntivu shoal, nearly 2 miles in length in a north and north-west and opposite direction, and about a third of a mile in width, has depths of from 2 to 3 fathoms over it, the shoalest water being near its southern extreme; its northern end is 2⅓ miles northward of the north-east side of Delft island.

Anchorage.—In strong north-east winds temporary anchorage can be obtained on the western side of Delft island with the south end of the high trees bearing about E.N.E.

Delft channel, between Neduntivu shoal and the shoal water off Nayinativu, is clear, and about 1¼ miles broad between the 5-fathoms contour lines; it has depths of from 5½ to 6 fathoms.

Directions.—Approaching Delft channel from the southward a vessel should steer to pass through its eastern part and nearly 1½ miles south-westward of Nayinativu island, and when its south point bears about E. ½ S. keep the eastern side of the trees on the north-east point of Delft island bearing South astern* and steering North, pass over

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* Trees have been planted on the islands in considerable numbers since these directions were written, so that bearings of the extremities of clumps should be used with caution.

Chart 2197, Point Pedro to Delft island. Var. 0° 40′ W.

the north end of the shoal water extending northward of Delft island, in a depth of about 5 fathoms.

A light-draught vessel might cross this shoal water further to the southward, where there are depths of about 4 fathoms.

Sailing vessels, working into Palk bay against the South-west monsoon, should keep on the northern coast of Jafna peninsula, and work down to Delft island, and thence stand across to the western side of the bay, where land and sea breezes with smooth water will be met with.

In the North-east monsoon, work northward of the Ceylon side of Palk bay as far as Eluvaitivu, then stand over to the western side of the bay and continue working to windward in smooth water.

Chart 68a, Palk strait and the Gulf of Manár.

PALK STRAIT, named after the Governor of Madras, 1755-1763, extends north-eastwards from Palk bay to its northern entrance between Point Pedro and Calimere point, where it is about 36 miles in width; the depths are from 7 to 8 fathoms in its south-west portion, but it is obstructed at its north-east end by South and Middle banks.

The channels generally used are either between the coast of Ceylon and the South banks, where the depths are 5 fathoms, when crossing the north point of Point Pedro shoal, or between Middle bank and Calimere point, which has from 3½ to 4 fathoms water; there are other places where the banks may be crossed in the latter depths, but, being out of sight of land, there is no guide for them, and they are not recommended.

Chart 2197.

Analaittivu (*Lat. 9° 40′ N., Long. 79° 47′ E.*), 1¾ miles northward of Nayinativu, is 2¼ miles long in a north-north-east and south-south-west direction, and one mile broad; part of the island is covered with trees 70 to 80 feet high. Pulivantivu, a small islet 15 feet high, on which there is a white temple and a single palm, lies on its southern side, and Parititivu, a similar islet as regards height, on its north-eastern side; from the westward these islets appear to be parts of Analaittivu.

Shoal water with depths of about 2 fathoms extends between Analaittivu and Nayinativu, and the 5-fathoms contour line is from one mile to 1½ miles westward of these islands, but on the south-western side of Nayinativu it approaches to within half a mile.

Eluvaitivu, 1½ miles north-eastward of Analaittivu, is nearly 2 miles in length in a north and south direction, and about 3 cables in width; it is low and covered with trees about 70 feet in height.

Chart 2197, Point Pedro to Delft island. Var. 0° 30′ W.

The edge of the shoal water, which extends about a quarter of a mile off the northern half of its west coast, takes a west-south-west direction and joins that off the north coast of Analaittivu.

Velanai island, nearly 10 miles in length in a north-west and south-east direction, and about 4 miles in greatest breadth, is situated north-eastward of Punkudutivu and Nayinativu and eastward of Analaittivu and Eluvaitivu islands, with a basin about 3 miles in extent, and having depths of from $1\frac{1}{4}$ to $1\frac{3}{4}$ fathoms between.

KAITS (*Lat. 9° 42′ N., Long. 79° 50′ E.*), a port situated on the northern side of Velanai island and southward of Karativu, is open throughout the year, but its busiest time is during the South-west monsoon when there are sometimes 30 or 40 vessels at the anchorage. The entrance is across the flats between Eluvaitivu and Karativu, and southward of Fort Hammonheil, the quarantine station, which is about a quarter of a mile off the south-west point of Karativu.

Native craft are hauled up and repaired here.

Anchorage.—Steam vessels anchor in a depth of 4 fathoms, over sand, with the north point of Eluvaitivue bearing S.E., distant about one mile.

Small native vessels lie in the outer anchorage, in from 2 to 3 fathoms, at $1\frac{1}{2}$ to 3 miles north-westward of Fort Hammonheil, and discharge part of their cargo before entering the port.

Directions.—A small vessel bound to Kaits harbour should bring Fort Hammonheil to bear S.E. by S., and steer for it on that bearing, which leads over the best water on the flat, and when the fort is distant about one mile, and the depth 9 feet, the course may be altered to round it on its southern side at a distance of about 3 cables; then, keeping on the northern side of the harbour until past a bungalow on the shore, anchor off the Custom-house in a depth of about 2 fathoms, over mud. The least depth at low water, spring tides, in this route is $4\frac{1}{2}$ feet.

Supplies.—A limited supply of fresh provisions may be obtained at the small town of Kaits.

KARATIVU, the south-west point of which is $2\frac{1}{4}$ miles eastward of the north point of Eluvaitivu, is the northern island of the group, is about 4 miles in length in a north and south direction, and $2\frac{3}{4}$ miles in greatest width; it is separated from the peninsula by a shallow channel about 3 cables in width, in which is a low coral island covered with trees, the highest of which, on the north-western point, are about 90 feet in height. A causeway connects Karativu with Jafna peninsula.

General charts 68a, 828, 70.

Chart 2197, Point Pedro to Delft island. Var. 0° 30′ W.

A sandhill, 20 feet in height and with some palms on it, at the north-eastern point of the island, is conspicuous from the north-west. At the entrance to the channel between Karativu and the peninsula there are numerous rocks and shoals, closing the channel except to boats.

LIGHT (*Lat. 9° 46′ N., Long. 79° 52′ E.*).—At Kovilam, on the north-western point of Karativu, a *red fixed* light is exhibited, at an elevation of 60 feet above high water, from a steel mast, painted white, and should be seen from distances of between 6 and 8 miles in clear weather.

Shoals.—Off the north-west and north sides of the flat which occupies the space between Eluvaitivu and Karativu islands, and with Kovilam light mast bearing between E. by N. ¼ N. and S.E. by E. ¾ E., are several shoals, with from 2 to 3¾ fathoms water over them, the outermost of these, with a depth of 3½ fathoms, being 5⅓ miles west-north-west of the light mast.

These shoals, composed of hard sand, with probably coral underlying them, are surrounded by depths of from 4 to 5 fathoms, and their locality should be given a berth of at least a mile by a vessel of any draught.

WEST CHANNEL, between the 5-fathoms contour line surrounding the above-mentioned shoals, and a similar line bounding the south-west extreme of South bank, has a least depth of 5½ fathoms in it; the middle of its eastern entrance is about 4½ miles north-westward of Kovilam light mast, whence the channel, which is nearly 1¼ miles in width, has a westerly direction for about 3 miles.

Directions.—From the eastern entrance to West channel the sandhill, 20 feet high, on the north-east point of Karativu bears S.E. by E. and Hammonheil fort S. by E. ½ E., and a W. by N. course leads through it.

COAST.—From the eastern entrance point to the shallow channel which separates Karativu from the main island, the coast curving round to the eastward for a distance of about 9 miles to Kankesanturai, is bordered by palmyra and cocoanut palms, and fringed by a coral reef.

A conspicuous sandhill is situated a mile westward of Matakal village, and a Roman Catholic church is nearly 2½ miles westward of Kankesanturai, with a white cliff, 26 feet high, about a mile further eastward.

Depths off-shore.—The 3-fathoms contour line is about one mile northward of the entrance to the shallow channel between Karativu and the main island, from which position it takes a northerly direction and curves round to the eastward, forming a bank with depths

Chart 2197, Point Pedro to Delft island. Var. 0° 30′ W.

under 3 fathoms about 4 miles in length and extending fully 2 miles off-shore.

A coral patch with 1¾ fathoms water over it, is situated near the edge of this bank, and 1¾ miles north-westward of the conspicuous sandhill westward of Matakal; the bottom within the patch is uneven and foul.

Plan of Kankesanturai on 2197.

KANKESANTURAI (*Lat. 9° 49′ N., Long. 80° 3′ E.*), the chief port of call for steamers during the South-west monsoon, has a Custom-house, and the custom's officer is Master attendant for the port; it has a considerable trade with the ports of southern India.

Two stone piers or bastions are on the beach, and there is a small wooden pier which can be used for boats during the South-west monsoon. Cargo boats anchor off the beach, and can be obtained for landing cargo during fine weather.

LIGHT.—On the western pier at Kankesanturai, a cylindrical tower of masonry, 73 feet in height, exhibits, at an elevation of 75 feet above high water, a *green fixed* light, which should be visible from a distance of 14 miles in clear weather, but is obscured by trees when bearing northward of East.

Anchorage may be obtained in a depth of 5 fathoms, over sand and mud, with the lighthouse bearing S.S.W. ½ W., distant 3½ cables, and the rocky point, 1½ miles to the westward bearing W. by S., and just shutting in the point about 3 miles westward of it. Westward of the lighthouse the bottom is foul.

Tides.—It is high water, full and change, at Kankesanturai at 7h. 35m.; springs rise 3 feet, neaps rise 2 feet, neaps range 1¼ feet.

Communication.—Steamers of the British India and Ceylon Steamship Companies call regularly, and the railway from Elephants pass, which will be connected with the northern extension, runs on to the piers; there is also a post and telegraph office.

Coal and supplies.—About 1,000 tons of coal is kept in stock, and a similar quantity imported annually; there are 15 lighters holding from 4 to 12 tons, and from 300 to 400 tons could be put on board in 24 hours.

Only vegetables can be procured, and the water is from wells.

Chart 2197, Point Pedro to Delft island.

COAST:—From Kankesanturai the coast, with a curve to the southward, trends in an easterly direction for a distance of 5¼ miles to Tondaimannar, to the westward of which place is stony ground, with palms from 70 to 90 feet high, and eastward cultivation; the reef along this coast is close to the beach, and the 5-fathoms contour line

General charts 68a, 828, 70.

is about half a mile outside it; vessels should not approach within this distance.

Tondaimannar is marked by a cliff, 25 feet high, half a mile westward of which is the boat entrance to a backwater, which shows as a gap from the northward.

Point Pedro.—From Tondaimannar the coast trends in an east-north-east direction for nearly 5 miles to Palmyra point, where there is a boat entrance, and then turns to the east-south-eastward for 2½ miles to Point Pedro, which forms the north-east point of the peninsula; palmyra and cocoanut palms, from 70 to 90 feet high, border this coast, which is fringed by a narrow reef extending from half a cable to one cable off, and rapidly deepening to the 5-fathoms contour line, which is about 3 cables from the beach.

Valuvedditturai, about 2¼ miles eastward of Tondaimannar, is a port where small vessels are built, and a break in the reef affords a good boat entrance. There is a considerable village, and a native market where fresh provisions can be obtained.

LIGHT (*Lat. 9° 50′ N., Long. 80° 15′ E.*).—A *red fixed* light is exhibited, at an elevation of 60 feet above high water, from a steel mast, painted white, and situated near Point Pedro; it should be visible in clear weather from a distance of 7 miles.

Town.—The town and port of Point Pedro, where there is a Custom-house and several bungalows on the beach, is situated about three-quarters of a mile westward of the point; the Custom-house, with its red roof, near the landing stage, is conspicuous. Abreast the Custom-house there is a boat channel through the reef; the port is open from about the middle of February to the middle of October.

Supplies.—Fowls and vegetables can be procured from the native market; bullocks and sheep might be obtained by giving notice.

SOUTH BANKS consist of five shoals; the northern, with 3 fathoms water over it, lies 15 miles north-north-west of Kankesanturai lighthouse; the least water, 2½ fathoms, is on a shoal about 13½ miles north-north-west of the lighthouse, and the others, with 2¾ to 3 fathoms water over them, lie within a space of about 4 miles southward of the 2½-fathoms shoal. From South banks depths of 3½ to 5 fathoms extend about 12 miles south-westward to West channel, leading into Palk bay, and eastward to the northern end of Point Pedro shoal.

Chart 68a, Palk strait and the Gulf of Manár.

Middle banks.—*See* page 200.

Middle channel.—Between Middle and South banks is a channel about 4 miles wide with a least depth of 3¼ fathoms, and about its centre is a passage, one mile wide, with not less than

Chart 68a, Palk strait and the Gulf of Manár. Var. 0° 30′ W.

3¾ fathoms. This channel is out of sight of land, and latitude is the only guide.

Chart 2197, Point Pedro to Delft island.

EAST CHANNEL (*Lat. 10° 3′ N., Long. 80° 9′ E.*), a passage across the shoal water connecting Point Pedro shoal and South banks, lies from about 10½ miles north-north-eastward of Kankesanturai; it is from 2 to 3 miles broad, and has a depth of 5 fathoms.

Directions.—For East channel from the northward and eastward steer for the position given above, whence the tops of the trees between Tondaimannar and Point Pedro may be seen. Then steer S. ½ W., with Tondaimannar gap ahead on that bearing, and on the depth increasing from 5 to 6 fathoms the channel is cleared.

Chart 68a, Palk strait and the Gulf of Manár.

PALK BAY.—Western shore.—From Ramen point the coast trends in a west-north-west direction for about 20 miles, and then turns to the north-north-eastward for about 60 miles to Adriampatnam. This stretch of coast is generally low and level, and as there is neither harbour nor inlet it is only visited for the purposes of native trade.

Depths off-shore.—The 5-fathoms contour line, which is only about 1½ miles northward of Ramen point, gradually draws off the land to the westward, and where the direction of the trend of the coast changes it is about 6 miles off-shore, and probably increases its distance to 10 miles farther north, but this part of the bay is incompletely sounded out.

At the point where the Valiyar river discharges, about 40 miles northward of the change in the direction of the coast, a spit of hard sand with depths of less than 3 fathoms extends 15 miles to the eastward.

MADURA DISTRICT.—The coast between Pamban and Tondi is in the Madura district.

Chart 3581, Approaches to Pamban pass.

Mandapam, a small village about 2 miles westward of Toniturei, is rapidly growing in importance owing to it being the present terminus of a branch of the South Indian railway, which is in course of extension to Dhanush Kodi, at the east extreme of Pamban island, crossing Pamban pass over a masonry viaduct with a swing bridge; a service of steam vessels will connect Dhanush Kodi with Talamanaar, on Manár island, from which a branch railway will connect with the main line to Colombo. (Page 177.)

Communication by railway with India.

Coal.—Indian coal may be obtained from the South Indian Railway Company.

General charts 68a, 828, 70.

Chart 68a, Palk strait and the Gulf of Manár. Var. 0° 30′ W.

Shoal.—A detached patch with a depth of 3¾ fathoms over it lies 7½ miles north-eastward of Attankarai, a town near the mouth of the Vaigai river, on which is the town of Madura.

Devipatnam (*Lat. 9° 29′ N., Long. 78° 53′ E.*), a coast town, nearly 10 miles north-westward of Attankarai, is an emigration depôt, from which, during the South-west monsoon, natives are conveyed to Manár island.

Anchorage.—Small vessels anchor in depths of from 1½ to 2 fathoms, over sand and mud, with Devipatnam bearing West, distant about 2 miles. During the North-east monsoon there is no safe anchorage off Devipatnam.

Tondi, about 18 miles north-north-east of Devipatnam, is of some commercial importance, trade being carried on by native trading vessels. The principal import is teak, and export rice.

LIGHT.—From a steel mast, 52 feet in height, standing close southward of Tondi Custom-house, a *white fixed* light is exhibited, at an elevation of 63 feet above high water, which should be visible in clear weather from a distance of 6 miles.

Beacons.—Two masonry beacons, 15 feet in height, and painted white, mark the limits of the port.

Anchorage.—There is anchorage in a depth of 3 fathoms, over mud, with Tondi town bearing N.W. by W. ¾ W., distant nearly 4 miles, but open to all except off-shore winds. Small vessels anchor nearer the town in from 1¾ to 3 fathoms water, over stiff mud.

Communication.—Steamers of the British India S.N. Company, running between Colombo and Negapatam, call regularly.

Reported shoal water.—The 3-fathoms contour line extends for a distance of fully 5 miles south-eastward of Pasipatam, and about 8 miles eastward of Tondi; in this locality a depth of 1¾ fathoms at low water was reported in 1891, at 3½ to 4 miles, and a depth of 2¼ fathoms, at about 5¼ miles, south-eastward of Pasipatam mosque, which is 5¼ miles north-eastward of Tondi.

TANJORE DISTRICT extends from Tondi to the Coleroon river.

Kottaipatam, a coast town, situated about 17½ miles north-eastward of Tondi, may be distinguished by a single tree and plantation of high palmyras.

Anchorage.—The anchorage for vessels of light draught is in about 2¼ fathoms water, with Kottaipatam bearing W. by S.

Tides.—It is high water, full and change, at Kottaipatam at 11h. 0m.; springs rise about 1¼ feet.

Ammapatam, another coast town, is 3½ miles north-eastward of Kottaipatam.

General charts 828, 70.

Chart 68a, Palk strait and the Gulf of Manár. Var. 0° 30′ W.

Light.—A *white fixed* light is exhibited, at an elevation of 46 feet above high water, from the port flagstaff at Ammapatam when a steamer is expected, and should be visible in clear weather from a distance of 5 miles.

Sand spit.—A spit of hard sand, with depths under 3 fathoms over it, extends for a distance of 13 miles in an E. by S. direction from a low point formed by the mouth of Valiyar river, and situated nearly 6 miles northward of Kottaipatam.

The inner portion of the spit, from half a mile to one mile in width, has depths of one fathom and under, and stretches about 4½ miles eastward of the low point above mentioned, and on the outer part are depths of from 1¼ to 2¾ fathoms; a detached patch of 3 fathoms lies about 1¼ miles south-eastward of the extreme of the spit, the 5-fathoms contour line being close eastward of the shoal and 14½ miles from the shore.

A heavy swash of the sea generally prevails over this shoal, which should not be approached from the eastward nearer than a depth of 6 fathoms.

Shallavenaikapatam.—From the low projecting point at the entrance to Valiyar river the coast curves in a north-north-east direction for a distance of 14 miles to Shallavenaikapatam, where a high column situated near the coast is conspicuous, and visible seaward from a distance of 15 miles.

Adirampatnam (*Lat. 10° 20′ N., Long. 79° 22′ E.*), about 6 miles north-eastward of Shallavenaikapatam, is a place having considerable native trade with Ceylon and the ports in Southern India. Adirampatuam is considered a port of refuge for native vessels between the months of May and September.

Light.—A *white fixed* light is exhibited, at an elevation of 46 feet above high water, from a flagstaff, 56 feet in height and painted white, at Adirampatnam; the light, which is intended as a guide to the anchorage, should be visible in clear weather from a distance of 6 miles.

Anchorage.—There is anchorage in a depth of 3¼ fathoms, over soft mud, off Adirampatnam, with the town bearing North and Shallavenaikapatam column W. by N.; small vessels approach the town much closer. With southerly or south-easterly winds a heavy swell sets on this coast, rendering the anchorage unsafe, but in the North-east monsoon it is considered good.

Communication.—Steamers of the British India S.N. Company call regularly.

General charts 68a, 828, 70.

Chart 68a, Palk strait and the Gulf of Manár. Var. 0° 30′ W.

Trade is principally with Ceylon; the imports being mainly gunny bags and exports tobacco.

NORTH COAST.—The north coast of Palk strait from Adirampatnam trends eastward for a distance of 29 miles to Calimere point, and consists of mud flats covered with mangrove bushes; it is all overflowed during heavy rains and high spring tides.

Depths of less than 3 fathoms extend from 2½ to 4 miles off this coast; and the 5-fathoms contour line is found at about 9 miles south-south-eastward of Adirampatnam, but eastward of this position soundings have not been taken in depths over 4¼ and 4¾ fathoms.

CALIMERE POINT is the north-western entrance point to Palk strait and bay, and the southern point of the Coromandel coast; about 3 miles westward of the point are the Kodigeri bungalows, formerly a hot-weather resort, and 5 miles northward of the point, and a mile in-shore, are two dark-looking pagodas, shaped like oblong haystacks, which are in line bearing West.

LIGHT.—On Calimere point is a cement tower, 52 feet in height, which exhibits, at an elevation of 42 feet above high water, a *white flashing* light with a period of system of *twenty seconds*, the duration of the flash being *two and a half seconds;* it should be visible in clear weather from a distance of 12 miles.

A sand bank, dry at low water, inside which trading boats find shelter in bad weather, extends about 1½ miles north-eastward of Calimere point.

Depths off-shore.—The 5-fathoms contour line is about 7 miles, and that of 3 fathoms about 1½ miles, south-eastward of Calimere point.

Forest reserve.—In the vicinity of Calimere point is a Government forest reserve, where antelopes, spotted deer, and wild pigs are strictly preserved. Landing or shooting in the neighbourhood is prohibited.

Middle banks (*Lat. 10° 10′ N., Long. 79° 54′ E.*) consist of six detached shoal patches, with depths of from 1¼ to 3 fathoms over, and deeper water between them, which extend over a space of 8 miles in a north and south direction, with a greatest width of 3 miles.

The north-west patch, on which there is a depth of 2¼ fathoms, is situated about 4 miles south-south-east of Calimere point lighthouse, and the channel between it and the 3-fathoms contour line, southward of Calimere point, is about 1¾ miles in width, but a depth of more than 3½ fathoms cannot be relied on.

General charts 68a, 828, 70.

Chart 68a, Palk strait and the Gulf of Manár. Var. 0° 30′ W.

For channel between Middle and South banks, *see* page 196.

Directions.—In rounding Calimere point (*Lat. 10° 17′ N., Long. 79° 52′ E.*) by the channel between the shoal water off the point and Middle banks, the position may be obtained by cross bearings of the Kodigeri bungalows, the lighthouse, and the two pagodas northward of the point. The lead must be carefully used, and between Point Pedro and Calimere point vessels standing westward or towards Middle banks should not shoal to less than 8 fathoms.

Tides.—The maximum rise and fall during the South-west monsoon is 26 inches, but in the first three months of the North-east monsoon it is 33 inches.

Tidal streams.—In Palk strait the tidal streams are irregular, being influenced by the prevailing winds, but during February, March, and April they are more regular, changing every six hours at high and low water, and setting eastward during the rising tide, and westward during the falling tide.

From West channel to Delft island the tidal streams follow the general directions of the coast, setting northward and north-eastward during the rising tide, and southward and south-westward during the falling tide. The rate of the streams at springs is nearly one knot.

Currents.—During February, March, and April no current was observed in Palk strait, but it generally sets with the wind, except in May and October, when it is very variable.

In the middle of Palk bay the current sets to leeward in either monsoon.

Winds and weather.—In Palk bay, as in the Gulf of Manár, the south-west winds generally commence about the middle of April with fine clear weather. Early in May the South-west monsoon blows fresh, and continues until about the middle of August, when it moderates gradually and dies away about the end of September.

About the 10th October the North-east monsoon commences, with an overcast sky and hard squalls from different directions, accompanied by heavy rain, thunder and lightning, which weather continues during the month. The wind then becomes steady from the north-east, but during November, December, and January, there are frequent gales and a considerable amount of rain.

In the early part of February, the north-east winds slacken, and regular land and sea breezes set in, which continue till the middle of March, when calms prevail for several days, and the heat increases until the return of the south-west winds in April.

General charts 828, 70.

CHAPTER IV.

CALIMERE POINT TO COCANADA.

(Lat. 10° 17' N. to lat. 16° 57' N.)
(Long. 79° 53' E. to long. 86° 43' E.)

VARIATION: Increasing westerly 1' annually.

Chart 71, Madras to Calimere point. Var. 0° 20' W.

COROMANDEL COAST.—The name Coromandel (of doubtful origin, but generally supposed to be a corruption of Cholamandalam) is generally applied to the coast of the peninsula of India, between Calimere point on the south and Kistna river mouth on the north, a distance of about 365 miles. It is divided into the districts of Tanjore, South Arcot, Chengalpat, and Nellore, which are fully described in Chapter I.

All this coast is low and sandy, and exposed to a very heavy surf, the artificial harbour of Madras alone affording shelter for European shipping. Northward of Sadras (about 40 miles southward of Madras), the sea appears to have encroached upon the land to a considerable extent.

Coast.—From Calimere point (*Lat. 10° 17' N., Long. 79° 53' E.*) the coast, trending in a northerly direction for about 28 miles to Negapatam, is low, fringed with groups of palmyra and casuarina trees, and should not be approached nearer than depths of from 7 to 8 fathoms, which are found from about 5 to 10 miles off-shore, the water being deeper nearer the shore as Negapatam is approached, but in the vicinity of Negapatam shoal a vessel should not go inside the 10-fathoms contour line.

The two dark-coloured pagodas 5 miles northward of Calimere point, already alluded to, are the only distinguishable marks between that point and Negapatam.

Currents.—Vessels making the east coast of India should bear in mind that it is not at all unusual to experience currents setting from 2 to 3 knots in the offing. From February to July a strong current to the northward, and from October to December to the southward, may be expected, but is not always experienced. During

General charts 828, 70.

Chart 71, Madras to Calimere point. Var. 0° 20' W.

the progress of the survey in 1901 currents of from one knot to 2 knots were experienced outside the 25-fathoms contour line, decreasing between the 20 and 10-fathoms lines, with little or none inside the latter, whilst close in to the coast the current was occasionally reversed.

A set was usually found out of Palk strait when the current was running to the northward in the offing, and it is presumed that the reverse takes place when the current runs to the southward. Close in-shore tidal streams are felt, and they vary the strength of the current in the neighbourhood of Middle bank.

Negapatam shoal (*Lat. 10° 40' N., Long. 79° 56' E.*), composed of hard sand and stones, is about 6 miles in length, in a north and south direction, half a mile in breadth, and has general depths over it of from 4 to 5 fathoms, with several heads of 3½ to 3¾ fathoms. The least water found on the shoal in 1901 was 3½ fathoms, but a depth of less than 3 fathoms was reported in 1860. The northern end of the shoal, in the position given, is steep-to, with depths of 7 fathoms outside and 6 fathoms inside it; the southern end is ill-defined.

Plan of Negapatam and Nagar anchorages on 71.

NEGAPATAM, the principal seaport of Tanjore district, is situated at the mouth of the small Kaduveíyaru river. Salt is stored in large quantities at Negapatam. The limits of the port are defined by boundary pillars.

Landmarks.—The lighthouse; the tall spire of the church, about 1,000 feet north-westward of it, and the minaret, 148 feet high, at Nagar, besides four similar but smaller towers and two chimneys of the South Indian Railway workshops, are conspicuous marks for fixing a vessel's position. There are also two large Hindu temples, one in the centre, and the other in the south-western part of the town.

LIGHT.—From a white masonry column 83 feet in height, situated about a cable westward of Kaduveíyaru entrance, a *white group occulting* light with a period of system of *one minute* is exhibited at an elevation of 80 feet above high water, which shows thus:—light, *twenty-one seconds;* eclipse, *four and a half seconds;* light, *seven seconds;* eclipse, *four and a half seconds;* light, *seven seconds;* eclipse, *four and a half seconds;* light, *seven seconds;* eclipse, *four and a half seconds.* It should be visible seaward for a distance of 14 miles.

Storm and weather signals are shown from the lighthouse. *See* pages 74-76.

General charts 828, 70.

Plan of Negapatam and Nagar anchorages on 71. Var. 0° 20′ W.

Shoals.—Three small sandy shoals lie in the space of a mile in a north and south direction outside the 5-fathoms contour line, the southern, with a depth of 4½ fathoms, being 2$\frac{6}{10}$ miles eastward of the lighthouse.

Anchorage (*Lat. 10° 46′ N., Long. 79° 53′ E.*).—The anchorage off Negapatam is open to all but westerly winds, but the holding ground, of mud, is good, and the water shoals gradually; in heavy weather, a short broken sea gets up. Vessels anchor according to their draught of water and the state of the weather; in fine weather a good position is in depths of from 3¾ to 6 fathoms with the lighthouse bearing from W. by N. to S.W., and Nagar minaret from N.W. to N.N.W. ½ W.; during the North-east monsoon it is unadvisable to anchor in less than 5 fathoms.

Directions.—Vessels bound for Negapatam round the north end of Ceylon should keep outside the 10-fathoms contour line when near Point Pedro shoal, and not go under 8 fathoms off the Middle banks; between Calimere point and Negapatam they should also be outside the 10-fathoms contour until the conspicuous church spire bears westward of N.W. ½ W., which leads one mile northward of Negapatam shoal.

In the North-east monsoon sailing vessels should make the land northward of the port, as the current then runs strongly southward and into Palk bay, and leaving the port during that monsoon the southerly current must be considered and sailing vessels require a press of sail in order to clear the north-eastern coast of Ceylon.

River and bar.—The filling of Kaduveíyaru river in July annually by freshets causes an opening off the end of the jetty which gradually works southward, as the river begins to fall. About December a sandspit forms, which gradually increases until early in July, when it nearly blocks the river's mouth. In very fine weather, ships' boats can cross the bar without danger, although with the risk of a wetting; a steer oar is indispensable.

Tides.—It is high water, full and change, at Negapatam at 9h. 0m.; springs rise 2½ feet, and neaps 1½ feet.

Town.—Negapatam was one of the earliest settlements of the Portuguese on the east coast, and ranks as the ninth largest town in the presidency; it has several temples, only one being ancient, and is an important centre of emigration to the Straits Settlements and Natal. In 1901 the population was 57,190.

Communication.—Steam vessels of the British India S.N. Company between Madras, Rangoon, Penang, and Singapore call

Plan of Negapatam and Nagar anchorages on 71. Var. 0° 20′ W.

weekly, and those between Bombay and Calcutta fortnightly; there is a regular service by the Asiatic coasting steamers. There is communication by railway with the Indian railway system, and telegraphic communication with all parts.

Coal and supplies.—In case of necessity coal in small quantity might be obtained from the South Indian Railway Company, but they do not undertake to supply it under any other circumstances; it is brought off in boats holding about 5 tons.

A limited supply of fresh meat may be procured, but 24 hours' notice is necessary. Vegetables and bread can be obtained from Madras; water is good, and sent off in tanks holding 400 gallons.

Repairs.—Small repairs to machinery might be effected at Negapatam, but none can be executed in the foundries of the South Indian Railway Company. Boats drawing 4 feet unload at high water at a wharf on the bank of the river, one cable southward of the lighthouse. On the wharf is a crane capable of lifting 10 tons.

Trade.—The principal exports are rice, cotton piece goods, ground nuts, live stock, tobacco, cigars, turmeric, and skins; and imports, areca nuts, gunny bags, camphor, cotton piece goods, and apparel. The former were valued at Rs. 75,43,568, and the latter at Rs. 28,08,267, in the year 1908-09.

Quarantine.—A vessel with cholera or smallpox on board should hoist the International code flag R at the foremast. The regulations under the Venice sanitary commission on account of plague are in force.

Hospital.—Seamen are taken as in-patients at the civil dispensary.

Current.—The current off Negapatam generally sets with the wind, and appears to depend upon its direction and force.

NAGAR (Nagore) (*Lat. 10° 49′ N., Long. 79° 51′ E.*), $3\frac{3}{10}$ miles northward of Negapatam, on the right bank of Vettar river, is remarkable for its mosque and minaret; the main tower of the minaret, 148 feet in height, is visible from seaward before the coast.

Town.—Nagar town has chiefly a Mohammedan population, and there is a considerable trade carried on by native vessels with Burma and the Straits settlements; an annual feast held here is largely attended by pilgrims. For municipal purposes it is united with Negapatam.

Vettar river at Nagar is about one cable in width, but blocked by islets and shoals, and obstructed by a shifting bar, having about 4 feet over it, similar to that at Negapatam.

Anchorage.—There is open anchorage eastward of Nagar in 3½ to 4½ fathoms at 5 to 7 cables off-shore, and in deeper water

General charts 828, 70.

Plan of Negapatam and Nagar anchorages on 71. Var. 0° 10′ W.

further seaward; the holding ground is good. The left bank of Vettar river defines the northern limit of the port of Nagar; southward the port joins that of Negapatam.

Communication.—A branch railway connects Nagar with Negapatam.

COAST.—From Negapatam to Cauverypatam, about 23 miles northward, the coast continues very low and flat.

Chart 71, Madras to Calimere point.

KARIKAL (*Lat. 10° 55′ N., Long. 79° 51′ E.*), nearly 6 miles northward of Nagar, on the left bank of Arasalár river, is situated more than a mile inland; the coast in this vicinity is very low, with a few fishing villages. Koluncherri and Tirumali rivers, both like the Arasalár, barred streams, flow into the sea between Karikal and Nagar. These rivers can only be navigated after heavy rains have sufficiently swollen their streams, when cargo may be landed in flat-bottomed boats.

Landmarks.—The first objects seen on approaching Karikal are, from southward, the high minaret of Nagar, and from northward, the dome of Karikal church, which stands rather more than a mile from the beach, and the light-tower.

LIGHT.—From a stone tower, 56 feet in height, painted white and about a cable from Arasalár river mouth, is exhibited, at an elevation of 59 feet above high water, a *white fixed* light, which should be visible, in clear weather, from a distance of 10 miles.

Signal station.—The flagstaff generally flies the French flag, and communication can be made with it by the International code.

Anchorage, said to be the best on this coast, may be obtained in from 5 to 6 fathoms water, over mud and sandy bottom, with Karikal light-tower bearing W. ½ S.

Bar signal.—A blue flag hoisted at the beacon tower indicates that the bar is heavy and communication is prohibited.

Arasalar river.—The lading and unlading of cargo is carried on with little difficulty in Arasalár river, but the bar, which is marked by rollers, is very dangerous in October, November, and December; the depth of the mouth of the river is 8 feet at high water springs.

Tides.—It is high water, full and change, at Karikal, at 9h. 0m.: springs rise 4½ feet, neaps rise 2 feet.

Town.—Karikal is a French possession; the population of the whole settlement in 1901 was 56,595.

General charts 828, 70.

Chart 71, Madras to Calimere point. Var. 0° 10′ W.

Trade.—The exports consist of rice, cocoanut oil, sesame, coir, and piece goods, amounting in 1904 to £106,000; the imports are sugar, timber, sandal wood, French goods, and liquors, amounting in the same year to £49,000.

Communication.—Steamers of the British India Steam Navigation and Asiatic Companies call regularly at Karikal. A branch line of the South Indian Railway runs from Karikal to Peralam, but it requires to be extended from the town to the beach.

Coal and supplies.—Coal can be obtained by giving notice to the contractors, but only 1,500 tons are imported annually; there are 30 lighters of 40 tons, and 400 tons of coal could be put on board in twenty-four hours, but N.E. winds impede coaling.

Supplies of fresh meat, bread, and vegetables may be procured and drinking water in barrels.

Landing should not be attempted with ships' boats; there is a well-organised native boat service under the harbourmaster; the only boats used are the surf boats, here called chelingues.

Current.—The current is generally inappreciable close in-shore, but sets strongly in the offing, to the northward from February to July and to the southward from October to December.

Winds.—The North-east monsoon begins in October and ends in March; the South-west monsoon begins in March and ends in October. The changes of the monsoons are usually accompanied by bad weather. Cyclonic storms are rare, but they usually occur near the middle of November, or beginning of April. The rainy season commences towards the end of June and ends at the latter part of November.

TRANQUEBAR (*Lat. 11° 0′ N., Long. 79° 50′ E.*) is situated about 6½ miles northward of Karikal, on the left bank of a river, which is navigable only by native boats. The old fort of Dansborg, some large white houses, and lookout tower indicate its position from the offing. A small grove of casuarina trees flanks the south side of the town. The sea has encroached considerably abreast the fort, and protective stone groynes, which should not be approached too closely in boats, extend about a cable seaward.

Anchorage may be obtained in depths of from 5½ to 6 fathoms, about three-quarters of a mile off-shore, with the fort bearing about W. by N.

Town.—The town is one of the healthiest places in the district: the European bungalows are mostly situated within Dansborg fort, but the majority of the natives reside in Poraujar about one mile inland; in 1901 the population was 13,142.

General charts 828, 70.

Chart 71, Madras to Calimere point. Var. 0° 10' W.

Communication.—Steamers of the British India S.N. Company call occasionally, and it is proposed to connect the town with the South Indian railway system by a branch line.

Supplies.—Fresh meat, vegetables, bread, and poultry are procurable only in small quantities. Fresh water for shipping is obtainable from the river during the freshes, from July to December.

Landing.—Cargo is landed on, and shipped from, the beach abreast the custom-house in masula boats, each carrying about 4 tons. During the North-east monsoon, there is a depth of about 6 feet at high water on the river bar, when native craft of about 150 tons enter for repairs.

Trade.—The principal articles of export are twist, piece goods, coir, and spices, but there is now very little trade.

Cauverypatam, with two pagodas, is situated about 7 miles northward of Tranquebar. The land northward of Cauverypatam begins to rise slightly, after being low and flat from Calimere point.

TIRMELWASSEL (*Lat. 11° 15' N., Long. 79° 51' E.*) in Tanjore district, about 6 miles northward of Cauverypatam, is a small town with a pagoda, situated near the mouth of the river, one of the many branches of the Cauvery.

Flagstaff.—A flagstaff for signalling purposes, 75 feet in height, stands just northward of the custom-house, which is a low tiled building on the left bank of the river, at Tirmelwassel. The flagstaff, which is the only landmark on this part of the coast, can be seen over the tops of the trees when approaching from the southward.

Anchorage.—Two boundary pillars on the coast mark the northern and southern port limits, and anchorage may be obtained in 5 to 6 fathoms water, with the flagstaff bearing from West to W.S.W.

The anchorage should be approached with caution, as the soundings shoal rapidly inside the 5-fathoms contour line.

SOUTH ARCOT DISTRICT, of which Coleroon river is the southern boundary, has a coastline of about 50 miles; its ports being Porto Novo and Cuddalore. *See* Chapter I., page 12.

Coleroon river is 94 miles in length, drains an area of 1,404 square miles, and flows into the sea by two mouths, one at 10 miles, and the other at 13½ miles northward of Tirmelwassel. The southern mouth has a shoal extending 6 cables off it and on which the sea breaks heavily during the strength of the North-east monsoon.

The waters of Coleroon river are controlled by three dams, and are largely used for irrigation purposes; it is crossed, at about 10 miles above its mouth, by the South Indian Railway, over a girder bridge. The river is navigable, by small craft, for a few miles from its mouth.

General charts 828, 70.

and rice is exported from it. The four Chillumbrum pagodas, situated about 7 miles westward of Coleroon river mouth, are remarkable, and can be distinctly seen over the trees abreast of Coleroon river.

Coleroon point (*Lat. 11° 28′ N., Long. 79° 48′ E.*) is formed by a long sandy spit, just above high water, extending 3½ miles to the northward of the southern entrance to Coleroon river; the point, having no vegetation on it, is difficult to distinguish from seaward. Between Coleroon point and the mainland, a distance of 1½ miles in a westerly direction, are numerous sandbanks covered and uncovered.

Porto Novo is situated on the left bank of Vellar river, 3 miles north-westward of Coleroon point.

Vellar river.—The Vellar river, which for some distance forms the boundary between Trichinopoli and South Arcot, has a total length of 135 miles and has several dams across it for irrigation purposes. The depth on Vellar bar is 3 feet at low to 4½ feet at high water, spring tides; the river is broad and shallow.

It is tidal for 7 or 8 miles from its mouth and for part of that distance is navigable by small craft at all seasons of the year; about 2 miles southward of its mouth it is supposed to meet the waters of the Coleroon, and every year, in the Tamil month Masi (February-March) a procession, with an idol, congregate on the shore abreast this spot, and the people bathe. Native craft enter the river for repairs, and cargo is landed at a jetty opposite the custom-house.

Anchorage.—From about the middle of October to nearly the end of December, vessels should anchor from 2 to 3 miles off-shore in depths of from 6 to 9 fathoms, with the flagstaff bearing W. by S., but after the month of January, during the South-west monsoon, and in fine weather, anchorage may be taken up closer in, according to draught.

Directions.—The 10-fathoms contour line passes only about one mile outside the shoal water of the southern mouth of the river and Coleroon point, and vessels should not close this part of the coast at night nearer than a distance of 4 miles, which, from a distance of 10 miles southward of, to abreast, the point, will give a depth of 20 fathoms, but northward of the point only 10 fathoms will be found at the same distance.

Vessels approaching Porto Novo from the southward should keep outside the 10-fathoms contour line until Porto Novo flagstaff bears W. by N., when the anchorage may be steered for.

Town.—An English settlement was established at Porto Novo in

1683, and for some time the place had a considerable trade which has since declined; in 1901, the population was 13,712. It is a depôt for salt, and a remarkable description of mat is made from wild pine apple leaves.

Communication.—The British India S.N. Company have a service of steamers, and there is railway communication to the southward with Negapatam and to the northward with Madras; telegraphic communication with all parts.

Supplies.—Small supplies of provisions may be obtained.

CUDDALORE (*Lat. 11° 43′ N., Long. 79° 47′ E.*), the principal port and capital of South Arcot district, is on the backwater formed by the confluent estuaries of Gadilam and Paravanur rivers, and about 13 miles northward of Porto Novo; the coast between being low, with occasional sandhills, appearing from the offing like small islands.

Cuddalore flagstaff, on a sandhill near the coast and about 4 cables northward of Gadilam river entrance, is most conspicuous, and has a white building close to and a church southward of it. About 2 miles northward of the town are the ruins of fort St. David, the south end of which is visible from seaward through a gap in the casuarinas, and a small white pillar, on a sandhill near the fort, marks the northern limit of the port.

Gadilam river bar has about 3 feet over it at low water, spring tides, and cargo boats discharge at a jetty up the river near the custom-house. Vessels of 200 tons have occasionally entered the river for repairs, mud docks being cut by the natives.

LIGHT.—From a tower surmounting a square house, the whole 31 feet in height and painted white, is exhibited, at an elevation of 65 feet above high water, a *white group occulting* light having a period of system of *one minute*, and showing thus:—four eclipses, each of *five and a half seconds* duration, separated by intervals of *six seconds*, and followed by an interval of *twenty seconds;* it should be visible in clear weather from a distance of 12 miles.

Storm signals are shown at Cuddalore. *See* pages 74-76.

Anchorage may be obtained in 5 or 6 fathoms water, with Cuddalore flagstaff bearing W.N.W.; this is the most convenient anchorage for communicating with the shore.

Town.—The town is made up of several different quarters, of which Cuddalore New town, noted for its ancient Siva temple, contains the principal public offices and European bungalows, picturesquely situated amongst fine trees on the four sides of a large open

Chart 71, Madras to Calimere point. Var. 0° 10′ W.

plain. Cuddalore Old town is the seaport and chief trading centre of the district.

Two rivers, the Ponnaiyar and the Gadilam, liable to heavy floods, pass through the town, which also contains the chief public offices and courts, an Anglican and a Roman Catholic church, besides the Customs and marine establishments. In 1901 its population was 52,216.

Communication.—Steamers of the British India S.N. Company, running between Madras, Singapore, and Rangoon, call weekly, and those between Bombay and Calcutta fortnightly, and coasting steamers call periodically, also foreign vessels, to load with ground nuts. It is connected by rail with Porto Novo to the south, and Madras to the north, the station being in the New town; there is also telegraphic communication.

Coal and supplies.—A large quantity of coal is kept in stock for the South Indian railway, but the authorities do not undertake to supply vessels except in case of necessity.

Bread, meat, poultry, vegetables, and fruit are cheap, and procurable in any quantity. A part of the town is supplied with filtered water from a reservoir, and fresh water can be supplied to shipping.

Hospital.—There is a municipal hospital, and also dispensaries.

Trade.—Ground nuts form the chief article of export, and others are oils, seeds, fodders and cattle food, yarns and textile fabrics, rice, indigo, and hides; the principal imports are areca nuts, pepper, coal, timber, spices, sugar, and European stores and provisions. The former were valued at Rs. 60,33,590, and the latter at Rs. 8,16,661 in the years 1908-09.

Climate.—The town is said to be healthy, and elephantiasis, once frequent, is disappearing. The average rainfall is 45·5 inches, of which 37·7in. fall from August to December

Plan of Pondicherri anchorage on 71.

PONDICHERRI (*Lat. 11° 56′ N., Long. 79° 50′ W.*), the chief settlement of the French possessions in India, and residence of the governor, is situated 13 miles northward of Cuddalore. *See* Chapter I., page 14.

The land northward and at the back of Pondicherri town is from 150 to 240 feet higher than that in the vicinity of Negapatam or Madras, and the Cathedral, and a high chimney of a factory which is situated 1¼ miles west-south-west of the lighthouse, all serve to point out the place.

At times there is almost a total absence of surf on the coast, but landing on the beach should not be attempted in ships' boats. The small river which flows through the town admits native craft only.

General charts 828, 70.

Plan of Pondicherri anchorage on 71. Var. 0° 10′ W.

LIGHTS.—A *white fixed* light is exhibited, at an elevation of 89 feet above high water, from a masonry tower 49 feet in height, and situated in the square near the beach; it should be visible in clear weather from a distance of 12 miles.

From a mast surmounting a small cabin on the end of the landing pier a *red fixed* light is exhibited, at an elevation of 31 feet above high water, and should be visible in clear weather from a distance of 2 miles.

When the surf is heavy, and approach to the pier prohibited, a *green fixed* light is exhibited at 26 feet above high water, which should be seen about 3 miles.

Pier.—An iron screw pile pier for landing and discharging cargo, and at which ship's boats can land during the fine season, extends about 800 feet seawards from near the lighthouse

Signal stations.—Both the town flagstaff, and the flagstaff at the port office, are signal stations, with which communication may be made by the International code.

Signals.—A blue flag hoisted at the port flagstaff indicates that, in consequence of the surf, communication with the shore is prohibited; and the same flag hoisted above the crane indicates that landing at the pier is forbidden, when communication can only be made by surf boats (chelingues).

Port regulations.—The local signals and the regulations of the port are delivered to merchant vessels immediately on arrival, and the directions therein should be strictly complied with.

In case of a vessel not answering signals made to her from the port, attention is drawn by guns being fired. The signal for a boat is answered by a blue pendant at the port office.

Vessels are not allowed to make fast to any part of the pier.

Quarantine.—The quarantine regulations are somewhat strict for vessels direct to or from Europe, and no communication is allowed with the shore, or with any vessel or boat in the roadstead, until pratique has been granted, unless the vessel arriving is in danger, when other vessels are bound to send assistance, whether pratique has been granted or not.

Anchorage (*Lat. 11° 56′ N., Long. 79° 51′ E.*).—The general anchorage is in from 6 to 7 fathoms water, with the lighthouse bearing W.N.W., distant one mile, but from October to December, when bad weather may be expected, it is desirable to anchor about half a mile farther out, in depths of from 8 to 9 fathoms; a long scope of cable is recommended, and precautions against bad weather should always be taken.

General charts 828, 70.

Plan of Pondicherri anchorage on 71. Var. 0° 10′ W.

Directions.—During the North-east monsoon, a sailing vessel from the southward should work northward near the middle of the Bay of Bengal until the land can be made in about latitude 12° 30′ N., and thence run down the coast to Pondicherri, keeping in depths of from 12 to 15 fathoms. After mid-February the route is direct after rounding Ceylon. As the gales on this coast generally commence from north-west, vessels are enabled to get away from Pondicherri to the south-eastward, and return when the gale is over.

During the South-west monsoon, from the southward, sailing vessels should make the coast in the vicinity of Karikal or Tranquebar, and bear in mind that the current sets northward.

Tides.—It is high water, full and change, at Pondicherri at 8h. 25m.; springs rise 3½ feet, neaps 2¼ feet

Town (*Lat. 11° 56′ N., Long. 79° 50′ E.*).—The town, which presents a picturesque appearance, is divided into two parts, White town and Black town, separated from one another by a canal. White town, with its streets built at right angles to each other, and shaded by avenues of trees, possesses many fine buildings; the principal public ones are Government house, two pagodas, the new bazaar, the clock tower, the barracks, the military hospital, the town hall, and the parish church, which, standing about 2 cables southward of the lighthouse, has two square towers with a cupola, and is conspicuous.

The population of the town was estimated to be 46,887 in 1906. A British Consul resides at Pondicherri.

Communication.—Steamers of the British India Steam Navigation Company between Madras and Negapatam have a weekly, and those between Bombay and Calcutta a fortnightly, service, and the Asiatic Company, and the Messageries Maritimes steamers call regularly at Pondicherri. Other companies, generally the Clan and City lines, send steamers occasionally when required.

A few Indian sailing ships trade between Pondicherri, Karikal, and other ports on the Coromandel coast.

Pondicherri has railway and telegraphic communication, a branch railway connecting at Villapuram with the Indian system.

Coal and supplies.—About 1,500 tons of coal are kept in stock, and about 4,000 tons imported annually; about 400 tons could be put on board in 24 hours, but N.E. winds impede coaling. There are 100 lighters holding about 2 tons each.

Fresh provisions, meat, poultry, game, fruit, vegetables, and eggs are plentiful, but expensive; drinking water is supplied in barrels.

Hospital.—Seamen are admitted to the colonial hospital.

Landing in ships' boats should not be attempted, except at the pier in fine weather.

General charts 828, 70.

Chart 71, Madras to Calimere point. Var. nil.

Trade.—The principal exports are ground and other oil nuts, rice, oilcakes, guinées (blue cotton cloths), and dried fish; and the imports, wines, brandy, dry grains and pulse, coriander seeds, and areca nuts. In 1904 the imports were valued at £179,000, and the exports at £1,102,000.

Winds.—The South-west monsoon blows from about the middle of March to October, and the North-east from about the middle of October until March. Gales are not uncommon from October to December, both inclusive; they generally commence from north-west, and veer northward and eastward; after a gale south-easterly wind and fine weather usually prevails.

In January the sky is mostly clear, and the north-east wind fresh; the wind is more eastward during February and until the middle of March, at the end of which month it blows from south-east by day and south-west at night.

During the South-west monsoon the land wind is sometimes very strong and gusty, and changes rapidly in direction and force, but seldom lasts long.

COAST.—From Pondicherri the coast trends in a north-north-east direction for 9 miles, and then a little more easterly for 29 miles to Palar river mouth. The country is low and sandy, except the slight elevation already mentioned northward of Pondicherri, and some hills, from 240 to 650 feet, from 6 to 16 miles north-westward of Allamparwa river; these can be seen at a distance of 5 or 6 miles from the coast.

Allamparwa river mouth, which is barred, is situated 22 miles northward of Pondicherri, and a thick grove of lofty casuarina trees northward of it is dark and conspicuous. A thick wood of palmyras trees stands at the back of the sandhills about 9 miles northward of Allamparwa.

Depths off-shore.—The coast bank between Pondicherri and Palar river mouth has depths of 5 fathoms at the distance of about half a mile from the beach.

CHENGALPAT (CHINGLEPUT) DISTRICT, northward of Pondicherri, notwithstanding its extent of coastline, which is about 80 miles, has, besides Madras, only three ports, Covelong, Ennore, and Pulicat, which are open roadsteads; boat traffic is carried on with Madras by means of a canal and backwater. *See* Chapter I., page 15.

Palar river (*Lat. 12° 28′ N., Long. 80° 10′ E.*) is a considerable stream, draining a large tract of country and receiving many tributaries, but, like other rivers on this coast, has a bar at its entrance

General charts 828, 70.

which completely closes in the dry season; a canal connects the river with Madras. A plantation of lofty cocoanut trees stands on the north side of the river.

Breakers extend about 3 cables, and a spit, on which the depth is 2¾ fathoms, is nearly one mile from Palar river mouth.

Sadras, at one time famous for its fine muslin woven in looms, but from which the trade has completely fallen away, was in former years a flourishing Dutch settlement; it is situated about 3 miles northward of Palar river entrance. The village, which lies low, is almost completely hidden from seaward by trees; there is a ruined brick fort close to the shore, with a cemetery, which contains curious and elaborate tombs inside it; a few weavers still live in the village, which in 1901 had a population of 1,564.

Sadras hills, the most conspicuous hills on this part of the coast, are 10 miles north-westward of Palar river entrance; the highest part of the range is 650 feet high, and close to it is Finger peak, 500 feet high, with a temple on its summit, making it easily recognised. Tirumani hill and Pataravakam hill, 768 and 703 feet high and 5¼ miles west-north-west and 6¼ miles north-north-west, respectively, from Finger peak, with smaller hills clustered round them, are also conspicuous.

COAST.—From Sadras the coast trends in a north-north-east direction for nearly 17 miles to Covelong point, northward of which it recedes slightly, and then continues for about 18 miles to the northward to Madras. Between Sadras and Covelong point the coast should not be approached to a less depth than 15 fathoms, as there are several rocky patches near it, especially northward of Tripalur reef.

Mahabalipur (Seven Pagodas) is a rocky point 9 miles northward of Palar river entrance; the pagoda from which the light was formerly exhibited is the only one visible from seaward.

LIGHT (*Lat. 12° 37′ N., Long. 80° 13′ E.*).—A masonry tower, 84 feet in height, on a conspicuous rock, exhibits, at an elevation of 135 feet above high water, a *white group flashing* light with a period of system of *ten seconds*, showing three flashes, occupying about *four seconds*, followed by an eclipse of *six seconds;* it should be visible from a distance of 18 miles in clear weather.

Tripalur reef is a rocky ledge, extending three-quarters of a mile off Mahabalipur; the in-shore ends of the ledge are awash, and the outer edge has a depth of 4½ fathoms over it, with 6½ fathoms close-to.

Rockingham patches have a least depth of 2½ fathoms on a patch, situated 4½ miles north-eastward of Mahabalipur lighthouse

Chart 71, Madras to Calimere point. Var. nil.

and one mile off-shore; the shoal patch is on the outer edge of uneven ground, one mile in extent, with depths of from 4 to 5 fathoms, and 5½ fathoms between it and the shore.

Two rocky heads, having 3¾ fathoms water over them, lie three-quarters of a mile north-east, and 1¼ miles south-south-west, of the shoalest spot.

Tiruporur hill, 148 feet high, with its summit crowned by a temple, is situated 6¾ miles northward of Mahabalipur.

Covelong, one of the earliest European settlements, but now of no importance, is situated 11 miles northward of Mahabalipur, and contains a few European bungalows on the south bank of the river, which flows into the sea; backwaters or the Buckingham canal connect Covelong with Palar river to the southward, and with Madras to the northward. A Roman Catholic church and the bungalows mentioned above, being almost entirely hidden by trees, are not easily made out. In 1901 the population was 1921.

Covelong point, extending from the coast just southward of Covelong, is scarcely distinguishable from it, except when close to.

Anchorage.—There is open anchorage in a depth of 7 fathoms with Covelong bearing West, distant about one mile.

Landing.—Rocks awash extend about 3 cables north-eastward of Covelong point, and in the South-west monsoon landing may be effected near them.

COAST.—From Covelong the coast trends about north for nearly 18 miles to Madras harbour, and is low throughout.

Ottirakam hills, the highest, sharp, conspicuous, and 548 feet high, is situated 8½ miles westward of Covelong point; it is near the southern end of a low range of hills stretching north and south. Pallavaram hills, double-peaked, with a temple on a summit 499 feet high, and St. Thomas mount, crowned with white buildings, 252 feet high, are conspicuous.

Plan of Madras roadstead on 575. Var. nil.

MADRAS (*Lat. 13° 6′ N., Long. 80° 18′ E.*), the capital of the presidency of Madras, and the seat of the government, is situated close to the sea on a low and sandy coast exposed to a heavy surf, and including a number of suburban tracts and villages, stretches nearly 8 miles along the coast, and runs 3½ miles inland. Notwithstanding natural disadvantages, owing to its railway communication and artificial harbour, it ranks third among the ports of India.

Aspect.—The approach from sea presents a low sandy coast studded with casuarina trees to the north and south, with several

Plan of Madras roadstead on 575. Var. nil.

handsome and conspicuous buildings as a centre. Fort St. George, in the middle of which stands the original fort, built in 1639, is a handsome fortress on the coast nearly a mile southward of the harbour; here also is St. Mary's, the earliest English church in India. The other buildings conspicuous from seaward are the native college, senate house, museum, St. Andrew's church, law courts, and post office.

The Cooum, a small and sluggish river, flows through the city and enters the sea southward of Fort St. George; its mouth is closed during the cold season. Immediately facing the harbour are the port office, consular agencies, and the offices of the principal merchants and shipping firms.

MADRAS HARBOUR, originally formed by two breakwaters, with an entrance to the eastward, between their heads, which is now closed, consists of a southern breakwater, about 2,600 feet long in an E.S.E. direction, turning to the N.N.E., with an outward curve to the eastward for a further distance of about 3,000 feet, to the root of a spur breakwater, which following a similar direction, has a length of 1,350 feet.

A short arm, about 300 feet, extends in a west-north-west direction from the root of the spur pier, and the north breakwater extends towards its head in an east-south-east direction parallel to the south breakwater, leaving between them an opening to the north-north-eastward, about 400 feet in width.

The harbour accommodates from 13 to 14 ships of deep draught, besides smaller vessels.

The coast southward of the harbour is advancing seawards, whilst northward it is receding, except where protected by stones. The harbour was re-dredged in 1893, but considerable shoaling has taken place southward of the harbour since the date of the last survey, and the depths shown on the plan should not be relied on.

Depths.—There are depths of 6 fathoms in the entrance between the breakwater heads, and about the same over an area extending 2 cables westward of the eastern part of the breakwater, from which they gradually shoal towards the shore. Vessels of any draught can enter the harbour at all times of tide.

LIGHTS (*Lat. 13° 5′ N., Long. 80° 17′ E.*).—The main tower of the law courts, an octagonal tower of brick and stone, with gilded dome, 190 feet in height, situated on the esplanade, about 2½ cables northward of Fort St. George, exhibits, at an elevation of 166 feet above high water, a *white group flashing* light, with a period of system of *thirty seconds*, showing thus:—flash, *two seconds;* eclipse, *three* *seconds;* flash, *two seconds;* eclipse, *twenty-three seconds;* it should be visible, in clear weather, from a distance of 20 miles.

North arm.—From a conical column of cement, 24 feet in height and situated on the outer end of the North arm, a *green fixed* light is exhibited, at an elevation of 33 feet above high water, and should be visible, in clear weather, from a distance of 4 miles.

Breakwater heads.—On each of the breakwater heads is a cylindrical column of cement, 26 feet in height, exhibiting, at an elevation of 35 feet above high water, a *red fixed* light, which, in clear weather, should be visible from a distance of 6 miles.

Pier (*Lat. 13° 5′ N., Long. 80° 17′ E.*).—An iron screw pile pier, 1,000 feet in height, with a T-shaped head, projects from the shore about midway between the inner end of the breakwaters, and at its extremity is a depth of 3¼ fathoms. Vessels are not allowed to lie alongside this pier, which is reserved for boats with cargo or passengers. Ships' boats use the pier in safety except in bad weather, when a masula boat should be employed.

Railway lines are laid along the pier for the conveyance of cargo, and steam cranes facilitate the discharging of cargo boats. There are 21 cranes on the pier (which can only be used for lighters) to lift from 1½ to 20 tons; and 10 other cranes to unload machinery, heavy packages, &c.

Regulations.—When the harbour is full, steam vessels are admitted in order of arrival, on departures taking place.

No vessel is allowed to enter or leave Madras harbour without having a pilot or the harbour master on board, unless authority to that effect has been given in writing by the conservator of the port. Vessels about to leave hoist International code flag N at the fore, and if about to enter the same code flag F. Only one vessel may leave or enter the harbour at the same time.

Large sailing vessels are only admitted into the harbour under very special circumstances and in settled weather.

No vessel may enter or leave the harbour between 6 p.m. and 6 a.m. without special authority.

International code flag H at the main is the signal for a doctor; flag D for an accommodation boat; the Union jack under the red ensign, or at night three *white* lights vertical, at the peak, for the police boat.

Pilots.—Vessels arriving at Madras should find a pilot in the vicinity of the end of the new North arm.

Buoys.—Two conical buoys, painted red, are moored northward of the harbour, for the use of vessels discharging cargo of a nature

Plan of Madras roadstead on 575. Var. nil.

not permitted to be discharged inside. The southern buoy is 2½ cables, and the northern buoy 6 cables northward of the north breakwater; both buoys are about 3¼ cables off-shore, and in a depth of 5 fathoms.

A buoy is moored 4 cables southward of the south-east elbow of the southern breakwater, but it is not used for purposes of navigation.

Anchorage *(Lat. 13° 5′ N., Long. 80° 18′ E.)*.—Madras road is open except to off-shore winds, and there is generally a swell from seaward, causing vessels to labour or roll considerably. Large vessels anchor in a depth of 9½ fathoms, nearly 2 miles from the shore, with the lighthouse, the main tower of the law courts, bearing southward of West, and should ride with at least 60 fathoms of cable out. Sailing vessels, except coasting craft, anchor in not less than 9 fathoms.

The bottom in many places is stiff mud, from which it is difficult to extricate the anchors. Vessels should not come into a less depth than 9½ fathoms at night; a second anchor should be ready for letting go, and the anchors should be buoyed.

During the bad weather season (*see* page 220) it is necessary for a sailing vessel to anchor well out, and be ready to proceed to sea, for the wind in cyclonic storms generally commences from north-west, with which an offing can be gained before it shifts to north-east and east, when it would be impossible to get away. If a vessel weighs or slips and runs seaward at the approach of a gale little danger is to be apprehended; but vessels remaining at anchor are likely to be driven on shore.

All vessels shall strike their yards and topmasts when required to do so by the the conservator of the port, by signal or otherwise.

The north and south limits of the port are marked by boundary pillars, and it extends eastward to a depth of 10 fathoms. A vessel anchored in more than 9 fathoms is liable to extra boat hire.

Prohibited anchorage.—Anchoring is prohibited in any part of Madras roadstead southward of the line of the lighthouse bearing West, in order to prevent injury to the submarine telegraph cable.

Ballast.—No ballast may be thrown overboard off Madras in a less depth than 12 fathoms.

Moorings are laid down in the harbour, and vessels are moored, head and stern, to buoys without anchoring, bows towards the middle of the harbour.

The buoys are placed about 600 feet apart, excepting one pair for very long steam vessels, which are 800 feet apart.

Moorings are reserved for vessels with petroleum, near the middle of the northern breakwater.

General charts 828, 70.

Plan of Madras roadstead on 575. Var. nil.

Surf.—The surf at Madras, north and south of the harbour, breaks at 300 feet from the beach in fine, but at 450 feet in squally, weather. During gales from the eastward it is said to break at a distance of 1,000 feet from the beach.

There are two lines of surf between which it is possible for a boat to remain without crossing either; the outer of these, or male surf, is the most formidable. With the wind off-shore the surf is often very high, but then there is only one slow heavy roller. In ordinary weather the surf wave is 2 to 4 feet high, in rough weather 6 feet, and during a gale 12 to 14 feet.

Masula boats, used for landing, are made of planks sewn together with cocoanut fibre.

Directions.—From February to September sailing vessels bound to Madras should make the land to the southward, sighting Sadras hills, on account of the strong northerly current then prevalent.

From September to January the land should be made to the northward, Kettle Bottom hill in latitude 13° 26′ N., the southernmost hill of Pulicat range, and about 33 miles westward of Pulicat lighthouse by day, or at night Pulicat light, are then good marks. From the northward, Madras main light (*group flashing*) should not be brought to bear southward of S.S.W. ½ W., using the lead.

Cyclones at Madras (*Lat. 13° 6′ N., Long. 80° 18′ E.*) usually commence with the wind from N.N.E. to N.N.W., and the wind changes in direction eastward or westward as the port is in the right or left hand semicircle of the storm. *See* pages 66-72.

Sailing vessels should have good sails bent, and topsails and courses close reefed. The ground swell has always a tendency to cast a vessel in-shore on parting or slipping, and this being dangerous, precaution should be taken to have a spring on the cable to cant the ship's head seaward.

With a north-west wind at Madras, the centre of the storm bears about E.N.E. to east. A vessel should therefore stand S.S.E. (not S.E.) until in the latitude of Pondicherri or Cuddalore, and then heave-to on the port tack, thus obtaining a clear drift, at first eastward, and then, with the rapid shifting of the wind, westward, back to port. But to carry out these directions a vessel must leave early in the storm; in fact, at once, on seeing or hearing the signal that a storm is approaching, as every hour is of importance.

Vessels in ballast, or discharging cargo, such as iron, timber, &c., should on the approach of a gale shift into 11 or 12 fathoms water, with two anchors down, and as much cable as possible out; the upper masts and yards must be struck, and the cargo

Plan of Madras roadstead on 575. Var. nil.

secured from shifting. This method of riding out a cyclonic storm has been successfully accomplished.

Storm signals are shown at Madras. *See* pages 74-76.

General directions.—On the warning signal being hoisted, commanders of vessels at anchor within the limits of the port are required to attend to the following directions:—

(*a*) Not to be absent from their respective vessels between sunset and sunrise.

(*b*) To keep their respective vessels prepared in every respect to proceed to sea at short notice.

(*c*) To proceed to sea without waiting for instructions to do so should they deem such a course prudent.

On the danger signal being hoisted, the commander of each vessel will take such measures for securing the safety of his vessel as he may consider requisite; no further instructions on that point will be furnished by the port authorities.

Vessels inside the harbour are usually sent to sea before the full development of a storm, and pilots take the vessels out. If not practicable to supply pilots, commanders would be instructed by signal or message to take their own vessels to sea.

Occasions may arise in which it would be impossible for vessels to go out of harbour; one occurred in 1896, when three or four vessels rode out a cyclonic storm inside the harbour. Of these vessels, one, through not taking proper precautions, parted and went ashore, but afterwards got off undamaged. The failure to send vessels to sea on this occasion was due to the ordinary squally North-east monsoon weather developing into a cyclonic storm during the night, when to have sent vessels to sea would have been more dangerous than leaving them at their moorings.

The vessels which rode out the storm dropped one anchor and eased off a few fathoms on their bow lines, tending their stern lines as required.

If a vessel in the harbour breaks adrift during the strength of a severe cyclonic storm, the safest course is to beach her, both in the interests of those on board, and for the welfare of the harbour.

Tides.—It is high water, full and change, at Madras at 9h. 1m.; springs rise 3½ feet; neaps rise 2¼ feet. The tides are subject to diurnal inequality, which may accelerate or retard the times of high and low water, and increase or diminish the rise by, at times, as much as one foot. In October, November, and December, the mean level of the sea is one foot higher than from February to May.

General charts 828, 70.

Plan of Madras roadstead on 575. Var. nil.

CITY (*Lat. 13° 5′ N., Long. 80° 17′ E.*).—Madras city, the capital of Madras presidency, and the third largest city in the Indian empire, is built, in a straggling fashion, on a strip of land 9 miles long, from 2 to 4 miles wide, and covers an area of 27 square miles; the land is low lying, almost dead level, being about 22 feet above sea level, and intersected by the Cooum and Adyar, two sluggish streams, which, except in the rains, form salt lagoons, separated from the sea by narrow ridges of sand.

The principal European quarters are in Egmore, Chetpet, Kilpauk, Nungambakam, Teynamfet, and on the strip of land on the north bank of the Adyar river.

George town, formerly Black town, the native quarter, and also the commercial centre of the city, lies immediately behind the harbour, and is more thickly populated than any other part; in the centre is the island, an open space which is the parade and recreation ground, besides which are the People's and Napier parks. The public buildings are more than usually handsome, but, being somewhat scattered over the city, they have not such a striking effect; there are also several statues and fine churches, besides mosques and Hindu temples.

Population.—In 1901 the population was 509,346, of which 4,228 were Europeans.

Communication.—There is weekly communication by steamers of the British India Company with Pondicherri, Cuddalore, Negapatam, and Rangoon, and a fortnightly service to Bombay, Calcutta, and the Straits.

The Madras railway system has three sections: The East Coast line to Calcutta, the North-west line to Bombay, and the South-west line to the west coast; the Rayapuram terminus is the station for the first, and the Central station for the others.

The South Indian railway runs to Tuticorin, from whence steamers ply to Colombo; the terminus of this line is at Egmore, but both the Madras and South Indian railways have a joint station on the beach, opposite the harbour, for the convenience of shipping.

The Buckingham canal affords transit from places along the coast between South Arcot district, in the south, and Guntar district in the north.

Two submarine cables connect Madras with Penang, one being *viâ* Pulo Weh; there is telegraphic communication with all parts.

A cheap and speedy service of electric cars is in operation in the most crowded parts of the city, and there is a telephone exchange and an hourly postal delivery; the Corporation maintain 187 miles of metalled roads.

Coal and supplies.—About 17,000 tons of coal are kept in stock, and about 200,000 tons imported annually; coaling is carried on by both bags and baskets, and from 300 to 450 tons can be put on board in 24 hours. About 1,400 tons of patent fuel is stocked, and 2,000 tons imported annually; 1,400 tons can be put on board in 24 hours.

Supplies of fresh meat, vegetables, and bread can be procured, and the town is supplied with water from Red hill lake reservoir, from which it is brought first by open channel, and then by pipes, and shipping receive it from tank boats.

Repairs.—Large repairs could be undertaken by three firms; there is one steam hammer of 1½ tons and several smaller ones; cranes will lift 20 and 10 cwts. respectively.

Hospitals.—There are nine hospitals and five dispensaries, and seamen are received at the general hospital.

Sailor's home.—There is a small sailor's home at Madras.

Quarantine is not enforced at Madras unless a vessel has infectious or contagious disease on board.

Time signals.—The semaphore at the Port office flagstaff, 103 feet above high water, is dropped at 1h. 0m. 0s. Indian standard time, or the meridian of 82° 30′ E., corresponding to 19h. 30m. 0s. Greenwich mean time. When the semaphore drops incorrectly, the International code signal M.Q.T. is hoisted immediately, and kept flying for half an hour; in this case the semaphore is dropped again at 2h. 0m. 0s. Indian standard time, or 20h. 30m. 0s. Greenwich mean time.

In addition to the above signal, a gun is fired by electricity from a battery near the lighthouse at noon, and at 8h. 0m. 0s. p.m. Indian standard time.

Madras observatory (*Lat. 13° 4′ 6″ N., Long. 80° 14′ 51″ E.*) is situated about 2¾ miles west-south-west of the law courts lighthouse. To this observatory all Indian longitudes are referred, and it is the point of departure of the trigonometrical survey.

Trade.—The arts of Madras are silk and cotton weaving, silver work and embroidery; there are weaving mills, cement and tile works, iron foundries, cigar factories, and aluminium utensils are manufactured.

The chief foreign exports are hides, skins, Indian piece goods, indigo, and raw cotton; and imports, European piece goods, twists, yarn, iron, steel, machinery, railway plant, and kerosene oil. In

Plan of Madras roadstead on 575. Var. nil.

the year 1908-09 the exports were valued at Rs. 5,55,59,558, and imports at Rs. 9,68,18,158.

Climate.—The climate of Madras has been described, with some accuracy, as three months hot, and nine months hotter. The cooler months are never cold, the mean temperature of December and January being 76°, but the summer heat is not so great as that of Northern India; the mean temperature for the year is 81·8°.

The annual rainfall for 85 years averages 49 inches, the greater part of which fall during the North-east monsoon, from October to December.

Wind, weather, and current.—The following table of wind, weather, and current prevalent on the Coromandel coast applies particularly to the vicinity of Madras:—

Months.	Wind.	Force.	Current.	Rates.	Remarks.
January	N.E. to E.N.E. veering to East.	Steady and fresh.	South-westerly or northerly.	1 to 1½ miles.	Currents irregular.
February	N.E. veering to S.E. and South.	Light.	Northerly parallel to coast.	1½ miles.	——
March and April.	S.S.E.toS.S.W. decreasing at sunset, succeeded by S.W. to W.N.W.	Strong. Not strong nor steady.	Northerly parallel to coast.	1 to 3miles at times.	In April, squalls occasionally from N.W.
May	South to S.W. veering towards the land at night.	Not strong nor steady.	Do.	1 to 2 miles	The most dangerous month in the bay exceptOctober Barometer should be watched, especially if N.N.W. wind sets in veering northward. At night (early part) squalls off the land from N.W.
June	S.S.W. and W.	Steady and increasing.	Variable, sometimes, southward.	Weak	Weather fairly settled near Madras. If wind veers northward, watch barometer
July and August.	S.S.W. to W., with rain and overcast sky.	Strong.	South-westerly or against the wind.	2 to 3 miles at times.	By keeping in-shore good passages have been made from north to south.
September	S.S.W. to W.	Decreasing in strength	South and S.S.W.	Strong	N.E. winds sometimes for two or threedaystogether.
October	Variable N.E. towards end of month.	Light At times light, at others strong, with rain and cloudy weather.	Southerly along the coast.	Strong	Weather uncertain,cyclonic storms likely. Very low barometer is not always accompanied by strong winds. A stormy sky should be heeded.
November and December.	N.E.	Strong and steady.	South-westerly, and southerly along the coast.	Strong 2 to 4 miles.	Unsettled till early in December. Caution necessary. Cyclonic storms often occur in November, and even in early December.

General charts 828, 70.

Chart 575, Madras to Ramapatnam. Var. 0° 10′ E.

COAST.—About 3 miles northward of Madras, plantations of casuarina trees commence, and extend to Ennore. There are several fishing villages on the coast, and a noticeable white native temple is situated about 4¾ miles northward of Madras.

Caution.—The use of the lead is necessary when navigating on the coast between Madras and Kalingaptam especially at night, as the currents are very variable, both in rate and direction, and sometimes set towards the land.

Ennore village, properly Kattivákkam, once a favourite resort for Europeans from Madras, from which it is distant 9 miles, is now, owing to the prevalence of virulent malarial fever, only a fishing village and centre of salt manufacture. The bungalows once occupied occupy a strip of land between the sea and the backwater. In 1901 the population was 3,192.

The sand dunes along the coast, which cover an area of about 20,000 acres, have all been converted into casuarina plantations, which has materially changed the physical aspect of the long stretches of coast in this vicinity.

Ennore is situated at the mouth of an extensive backwater, which finds its way into the sea, and is connected by canal and road with Madras. Vessels bound to Ennore enter and clear at Madras.

Ennore beacon (*Lat. 13° 14′ N., Long. 80° 20′ E.*), a white obelisk situated on a sandpit on the southern side of Ennore backwater entrance, is 54 feet high, and in the forenoon, with the sun shining on it, is conspicuous; in the afternoon it is not easily distinguished, but the gap in the trees formed by the backwater entrance is then noticeable.

Anchorage.—There is anchorage off Ennore in depths of from 6½ to 7 fathoms, about one mile off-shore, with Ennore beacon bearing N.W. ½ W.

Coast.—Between Ennore and Pulicat, a distance of 12½ miles, the coast protrudes slightly, and is low, sandy, and backed by an extensive plain, which is densely wooded near the beach.

Ennore shoal, a sandbank, with depths less than 3 fathoms, and with a least depth of 3 feet on it, projects north-eastward 1¾ miles from the coast, at 2½ miles northward of Ennore beacon.

PULICAT SHOALS consist of a chain of hard sandy patches having over them depths of from 2¼ to 3¾ fathoms. The southern patch, on which there is a depth of 2¾ fathoms, lies 6¾ miles north-north-eastward from Ennore beacon, and nearly 2 miles from the land; the northern patch, which has 3¼ fathoms on it, is 9½ miles in the same direction from that beacon, and 3¼ miles off the land, the shoals lying between these patches.

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Chart 575, Madras to Ramapatnam. Var. 0° 10′ E.

At three-quarters of a mile northward of the northern patch of Pulicat shoals is a patch of 4½ fathoms, and at 1¼ miles further north a patch of 5 fathoms.

There are depths of from 4 to 5 fathoms between the northern end of Ennore shoal and the southern patch of Pulicat shoals, but this passage is not recommended.

Clearing marks.—Kettlebottom hill, in line with Pulicat lighthouse, bearing West, leads northward of Pulicat shoals and patches of less than 5 fathoms; and Madras principal lighthouse bearing westward of S.S.W. ½ W. leads eastward of Pulicat and Ennore shoals.

Caution.—In the vicinity of these shoals the lead should be used, and the water not shoaled to less than 15 fathoms.

Tides.—It is high water, full and change, at Pulicat shoals at 9h. 25m.; springs rise 2¾ feet.

Current.—The current in the vicinity of Pulicat shoals is feeble and runs parallel to the coast.

PULICAT, a town on the southern extreme of an island at the south end of Pulicat lake, and the earliest Dutch settlement in India, came into English possession in 1795. Traces of the Dutch occupation are found in the ruins of a fort and in a cemetery. The town, which can be seen from seaward, was formerly a centre of trade with Penang and the Straits settlements, and was used as a sanatorium for Madras, but its use was discontinued on account of malarial fever, and it is now comparatively deserted. There is a high conspicuous monument just northward of the lighthouse. Pulicat is generally considered the southern limit where the Telugu language is spoken. The population was 5,448 in 1901.

LIGHT (*Lat. 13° 25′ N., Long. 80° 20′ E.*).—From a masonry column, 57 feet in height, painted white, and situated near the beach at Pulicat, a *white flashing* light, with a period of system of *five seconds*, is exhibited at an elevation of 68 feet above high water, and should be visible in clear weather from a distance of 14 miles.*

Directions.—From the southward pass outside Pulicat shoals, using the lead, and not shoaling to a less depth than 15 fathoms, and keeping Madras main lighthouse or light S.S.W. ½ W., or westward of that bearing, until Pulicat light bears West, when steer for it, and anchor with the light on that bearing in 6½ to 7 fathoms at about 2½ miles off-shore.

Trade.—The only trade is the export of woven cloth, dried fish, and prawns.

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* The lighthouse to be altered, in February, 1911, to a masonry column, with four alternate bands of white and black; the upper band being white.

Chart 575, Madras to Ramapatnam. Var. 0° 20′ E.

Mountains.—At about 30 miles inland is a range known as Pulicat or Nagari hills, the southern end of which is Kettlebottom, a remarkable flat-topped hill, bearing West from Pulicat lighthouse.

False Kettlebottom is another flat-topped hill lying nearly 4 miles north-eastward of Kettlebottom, for which it might be mistaken from the north-eastward.

Kambakam Durgam, the highest part, 2,546 feet in height, is situated about the middle of the range at 10¼ miles north-north-eastward of Kettlebottom.

Nagiri nose, a sharp peak, the upper part of which is crooked, 2,822 feet above high water, lies 10½ miles west-south-west of Kettlebottom, and, being 43 miles inland, is only seen from seaward in clear weather.

Pulicat lake, a salt-water lagoon about 37 miles long and from 3 to 11 miles broad, forms part of the inland water communication of this part of the coast; it is separated from the sea by a long, narrow sandy island and by the strip of sand on which the town stands.

It contains several islands, on which lime is made from shells, is connected with the sea by openings north of Pulicat and its other parts, and is influenced by the tide; it is seldom more than 5 feet deep in the dry season. It communicates at its southern end with Buckingham canal.

NELLORE DISTRICT has several ports, or open roadsteads, where cargo is shipped, and the Custom authorities have arranged that the north limit of one forms the south limit of the next; its coastline is about 110 miles in length. None of these ports are of much importance; the principal ones are, commencing from the south, Armagon, Kistnapatam, Ramapatnam, and Iskapalli. *See* Chapter I., page 17.

COAST.—From Pulicat lighthouse the coast is low and nearly straight in a north-north-west direction for 13 miles, and then turns to the northward for nearly 10 miles to Point Pudi, forming a shallow bight with soundings of 5 and 6 fathoms about half a mile from the beach.

The principal entrance to Pulicat lake is 2 miles northward of Pulicat lighthouse, and on the coast for 11 miles northward of the entrance are casuarina plantations, after which the trees are few until about a mile southward of Point Pudi, where there is a conspicuous clump of cocoanut palms on a sandhill about 80 feet high.

Beacon (*Lat. 13° 37′ N., Long. 80° 14′ E.*).—A wooden beacon, 35 feet above high water, is situated half a mile northward of Pulinjerikuppam village, but is not conspicuous.

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Chart 575, Madras to Ramapatnam. Var. 0° 20′ E.

Point Pudi, a low sandy point with hillocks 15 feet high, and clumps of palms in its vicinity, is about 22 miles northward of Pulicat lighthouse.

Point Pudi shoal, with depths of from one fathom to 2¾ fathoms, over sand, extends about 2¼ miles south-eastward of the point, off which the sea breaks in rough weather at the distance of a mile; the outer edge of this shoal, having depths of 4 fathoms, is distant 2½ miles from the coast.

COAST.—From Point Pudi the coast trends north-north-westward for about 21 miles to the mouth of Suvarnamukhi river, and then turns northward for about 9 miles to the entrance to Vupatteru river; Armagon lighthouse is situated about 7½ miles north-north-west of Point Pudi.

ARMAGON LIGHT (*Lat. 13° 54′ N., Long. 80° 11′ E.*).—From a column, 101 feet in height, and painted white, situated near Armagon or Monapalem village, a *white group flashing* light, with a period of system of *ten seconds*, is exhibited at an elevation of 97 feet above high water; it shows three flashes, occupying *four seconds*, followed by an interval of *six seconds*, and should be visible in clear weather from a distance of 15 miles.

Armagon shoal extends from near Point Pudi, within the 5-fathoms contour line, for about 14 miles northward, with depths over it of 1¾ to 4¾ fathoms; its south-extreme being about 2 miles north-north-east of Point Pudi; the shoalest part, 1¾ fathoms, which sometimes breaks, is about 3 miles north-north-east of Point Pudi, and the broadest part, about 2¾ miles, with 2 to 4 fathoms over it, is eastward of Armagon lighthouse.

The eastern edge of the northern end of the shoal lies 6 miles from the coast, with the 10-fathoms and 20-fathoms contour lines one mile and 2½ miles farther eastward. Some detached patches of 4½ and 5 fathoms lie off the north end of this shoal.

There is a channel half a mile wide leading into Blackwood harbour between Point Pudi shoal and Armagon shoal, with depths of 4 to 6 fathoms; it should only be used by coasting craft.

Directions.—Armagon lighthouse is the best landmark near Armagon shoal, as Gudali hill, about 13 miles north-westward of the lighthouse, a conspicuous flat-topped hill, 297 feet high, with a pagoda near its centre, is seldom visible from the outer part of Armagon shoal.

In approaching this part of the coast, sighting the land must not be relied on, as it is often obscured by haze; and the current, though generally setting with the prevailing wind, sometimes reverses its direction; therefore the lead must be used and the depth

Chart 575, Madras to Ramapatnam. Var. 0° 20′ E.

not shoaled to less than 20 fathoms; the position should also be frequently fixed by astronomical observations.

BLACKWOOD HARBOUR (*Lat. 13° 54′ N., Long. 80° 15′ E.*), lying between Armagon shoal and the coast, is an area about 3 miles in width, east and west, and 10 miles in length, with depths of from 4 to 6 fathoms, over sand and good holding ground.

Anchorage may be obtained in 5 fathoms water, over a bottom of coarse sand, with Armagon lighthouse bearing between W. by N. ¾ N. and W. by N. A convenient position during the South-west monsoon is with Armagon lighthouse bearing W. by S., distant about 2¾ miles.

Directions.—Keep in a depth of not less than 12 fathoms, until Armagon lighthouse bears S.S.W. ⅓ W., or Gudali hill W. by S., and then steer on the latter bearing for Gudali hill, passing northward of Armagon shoal in a depth of about 6 fathoms.

Dugarazupatnam, sometimes named Armagon, situated on an extensive backwater, the entrance to which is about 7 miles from Armagon lighthouse, is a small village, the resort of salt makers, where there is a post office and travellers' bungalow; its population in 1901 was 2,388.

Kudur, another small village, is 2 miles northward. Both these villages are on the Buckingham canal, and a considerable boat traffic passes through them in the South-west monsoon.

Beacon.—About 5½ miles northward of Kudur, on a sandy spit and quite close to the beach, is a wooden beacon with a cross, but it is not readily seen till close to. Inside the beacon is a shallow backwater, which runs northward, parallel to the coast for 3 miles.

Kottapatam.—At 1½ miles northward of the beacon and about a mile inland is Kottapatam town, and in its vicinity there are two conspicuous clumps of casuarinas. Eastward of the town is an entrance to Suvarnamukhi river, which is very narrow and too shallow for boats.

Vupatteru or Kandleru river.—About 7¾ miles northward of the entrance to Suvarnamukhi river is the mouth of Vupatteru river leading to an extensive backwater; the entrance is fairly good, and can be safely used by native craft of light draught. Kistnapatam, the chief port of the town of Nellore, with which it is connected by road, is situated on the left bank of the river, and close to the Buckingham canal. The trade is chiefly in salt.

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Chart 575, Madras to Ramapatnam. Var. 0° 20′ E.

Anchorage.—Coasting vessels occasionally anchor outside the mouth of Vupatteru river in depths of from 5½ to 6 fathoms, about 2 miles from the beach, but this anchorage is only safe during fine weather.

COAST.—The coast from Vupatteru river trends a little eastward of north for 6 miles, and then north for 15 miles to the mouth of Penner river. For 3 miles northward of Vupatteru river the coast is low and sandy, with plantations of casuarina trees, then sandhills 30 to 60 feet high continue for about 3 miles, to the point abreast Shallinger shoal, whence to Penner river it is low and sandy, with a few casuarina clumps and other trees, but nothing conspicuous.

Shallinger shoal, narrow, and with depths on it of 1½ to 2¾ fathoms over it, extends north-eastwards about 2½ miles from the coast at about 8 miles northward of Vupatteru river entrance; the 5-fathoms contour line is about 3 miles off-shore in this vicinity, and there is a depth of 4½ fathoms at nearly that distance off-shore.

The soundings outside the shoal are regular, and the coast may be safely approached to a depth of 8 fathoms.

Penner river (*Lat. 14° 36′ N., Long. 80° 10′ E.*), one of the largest in southern India, rises in Mysore, flows eastward through the Carnatic, and enters the Bay of Bengal 15 miles north-eastward of Nellore town; it is used for irrigation, and is crossed by dams at Sangam and Nellore. Nellore, the chief town of the district, is situated on the right bank of the river, on rising ground, at 11 miles inland.

From the mouth to Nellore the river has an average width of three-quarters of a mile, but it is so shallow that only native craft can enter, and it is liable to sudden freshets. The mouth of the river is not easily made out from seaward, as the river enters the sea behind a sandy point only a few feet above water.

Anchorage may be obtained off Penner river in fine weather and with off-shore winds, in from 5 to 7 fathoms, over sand and mud, at about 1½ miles from the coast.

Communication.—There is a station at Nellore on the Bezwada-Madras railway.

Narsimhakonda pagoda, on a hill, 504 feet high, westward of the town of Nellore and 17 miles inland, is painted white and sometimes visible from seaward between the bearings of W.N.W. and W.S.W., but it is not very conspicuous.

Buckingham canal, which connects Madras with the delta of the Kistna, passes along the coast at distances of a few hundred yards to 2 miles inland. It is largely used by native craft, and their masts

General charts 828, 70.

Chart 575, Madras to Ramapatnam. Var. 0° 20′ E.

or sails may generally be seen from seaward when northward of Penner river.

COAST.—From the mouth of Penner river the coast trends in a north-north-west direction, and is low and sandy, but the casuarina clumps are more continuous and the trees higher than southward of the river.

Iskapalli village (*Lat. 14° 45′ N., Long. 80° 7′ E.*), situated 10 miles north-north-westward of the mouth of Penner river, has a flagstaff on the beach which shows over the trees. It is a seaport and Customs station, and trade is carried on from the village by the Buckingham canal.

Nishanbotu, 229 feet high, is the north end of a ridge which lies nearly 11 miles west-south-west of Iskapalli.

Depths off-shore.—At 2 miles southward of Iskapalli the 10-fathoms contour line approaches the coast to 1¼ miles, and from this again draws off it, so that at Ramapatnam it is 7 miles off-shore.

Anchorage.—There is anchorage off Iskapalli in depths of 7 or 8 fathoms, over sand and mud, about a mile from the beach, and north-eastward of a bungalow situated three-quarters of a mile south of the village. The holding ground is good, but a heavy surf runs on the beach.

Supplies.—A few sheep, fowls, and a small quantity of fish are obtainable; other necessaries can be procured from Nellore, which is 23 miles distant, by road.

Coast.—The coast from Iskapalli trends north-north-westward, and is low and sandy to Ramapatnam, a distance of 18 miles; there is a short scrub, but no casuarina clump of any size on it, between Iskapalli and 1½ miles southward of Wuturpallipalem, at which place there is a high and large clump. Northward of Wuturpallipalem there are at first a few detached clumps, after which the trees are very even to Ramapatnam.

Shoals.—A shoal with a least depth of 2¾ fathoms on it at low water, lies 2 miles off-shore abreast Tummalapenta; the bottom in the locality is uneven, with depths of 3 to 6 fathoms for about a mile around the shoalest part.

Chart 1894, Ramapatnam to Narasapur point.

A shoal, about 2½ cables in extent, with 4 fathoms on it at low water, lies about 2¾ miles north-eastward of Tummalapenta and 2 miles off-shore; uneven bottom, with depths of 5 to 6 fathoms, extends about 5½ miles northward of this shoal.

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Chart 1894, Ramapatnam to Narasapur point. Var. 0° 20′ E.

On this part of the coast the water should not be shoaled to less than 10 fathoms until northward of Ramapatnam.

Ramapatnam (*Lat. 15° 3′ N., Long. 80° 3′ E.*).—At Ramapatnam village are some high casuarina clumps, and a church, the red spire of which is visible over the trees. Tettu temple, white, and 135 feet above high water, but not very conspicuous, is situated about 2 miles inland of the village.

COAST.—Northward of Ramapatnam the coast curves round to the north-north-eastward for a distance of 10½ miles to Munyeru river mouth; it is low and sandy, with several detached casuarina clumps.

Singarayakonda temple, on a hill 168 feet high, 11 miles northward of Ramapatnam and about 3½ miles inland, is red in colour, conspicuous from seaward and the only landmark between Ramapatnam and Kottapatam. A road leads from the coast at about a mile northward of Munyeru river, past the temple to Kandukur town, 10½ miles inland. There is some rising ground near the temple, which is, in places, visible through the casuarinas which fringe the coast.

Coast.—The coast from the entrance to Munyeru river trends in a northerly direction, with a bend to the eastward, for 6 miles to Paleru river, and then turns north-north-eastward for 8 miles to Kottapatam; it is low and sandy.

GUNTUR DISTRICT extends from the mouth of the Paleru river to False Point Divi, the western bank of the Kistna river, forming its eastern boundary, a distance of about 66 miles; its principal ports are Kottapatam and Nizámpatam. *See* Chapter I., page 19.

KOTTAPATAM, at which an extensive export trade used to be carried on, lies about one mile from the coast, and is connected by a good road with Ongole, about 8 miles north-westward, where there is a railway station. Most of the trade with Kottapatam is now carried on through the Buckingham canal, and the godowns on the beach are falling into disrepair.

Obelisk (*Lat. 15° 26′ N., Long. 80° 11′ E.*).—An obelisk, of a grey colour, 38 feet high, and standing on a sandhill 12 feet high, is situated close to the Custom-house on the beach at Kottapatam, and is visible from all directions seaward.

Landmarks.—Kandalur hill and Konijedu hill, the latter 485 feet high, are connected by a ridge, and lie 11 miles westward of Kottapatam.

Chimakurti, a mountain 2,093 feet high, 22 miles north-westward of Kottapatam, is conspicuous in clear weather.

General charts 828, 70.

Chart 1894, Ramapatnam to Narasapur point. Var. 0° 20′ E.

Anchorage.—There is anchorage during fine weather in a depth of 5 fathoms, about 2½ miles from the shore, with the obelisk at Kottapatam bearing N.W. by W. ¾ W.

In approaching Kottapatam do not shoal the water to less than 10 fathoms, until the position is known, for fixing which the landmarks above given or Singarayakonda temple are useful.

Town.—The town is well built, the streets and houses being constructed with unusual symmetry; in 1901 it had a population of 7,626, mostly Komatis, and it is noted for its extensive cultivation of ragi and for its casuarina groves.

Communication.—Ongole, a station on the East Coast railway, is connected to Kottapatam by a good road.

Trade.—It exports vegetables and firewood to Ongole.

Shoal.—A shoal about 2¾ miles in length in a north-north-east and opposite direction, and 1¼ miles in breadth, on which there is a least depth of 1½ fathoms, lies 4 miles north-eastward of Kottapatam obelisk. In the channel between this shoal and the land there are depths of from 2¾ to 4 fathoms. From the southern part of the shoal, patches with depths of 3 to 5 fathoms over them extend for a distance of 8 miles east-north-eastward of Kottapatam obelisk.

Mutapolli bank (*Lat. 15° 25′ N., Long. 80° 10′ E.*), about 4 miles in length in a north-east and south-west direction, consists of three patches of hard sand, generally marked by overfalls, with least depths of 3½ fathoms, 4 fathoms, and 4½ fathoms, respectively; the least depth, of 3½ fathoms, lies 9¼ miles eastward of Kottapatam obelisk.

From the outer part of Mutapolli bank the low coast is scarcely visible, even in clear weather, and Konijedu and Kandalur hills, which bear nearly West, are seldom seen, being 23 miles distant.

A shoal of 5 fathoms, one-quarter of a mile in extent, with depths of 5½ fathoms for 1½ miles north-eastward and south-westward of it, lies 7½ miles north-eastward of the shoalest spot on Mutapolli bank.

Directions.—Approaching Mutapolli bank, the water should not be shoaled to less than 14 or 15 fathoms by day, or 30 fathoms by night, and the lead should be going, as the soundings decrease rapidly from a depth of 30 fathoms.

Nizámpatam bay, formed between Kottapatam and False Point Divi, a distance of about 40 miles in an east-north-east direction, has depths under 10 fathoms, and is free from shoals except those already mentioned near Mutapolli bank; the shore is safe to approach to depths of 5 fathoms.

General charts 828, 70.

Chart 1894, Ramapatnam to Narasapur point. Var. 0° 20′ E.

Gundlakamma river mouth (*Lat. 15° 32′ N., Long. 80° 13′ E.*), 6 miles northward of Kottapatam, only admits boats in fine weather; the river comes down in freshes in September, October, and November, and during high tides it is navigable for about 2 miles inland from its mouth.

The shore of the bay, in the vicinity of the river mouth and for 4 miles northward, is low and sandy with but few trees; casuarinas then commence and continue to line the tops of the sandhills near the sea for 20 miles towards the head of the bay; the trees are 30 to 40 feet high, and in places extend more than a mile inland. There are three villages along this shore, one of which is a post town.

A boat passage to a backwater and the Buckingham canal lies 8½ miles northward of Gundlakamma river mouth. The entrance has a south-west direction across a bar, which has a depth of about 6 feet on it at low water, but is only available even for a boat in fine weather.

From the end of the casuarinas to Nizámpatam, a distance of 14 miles, the shore is backed by sandhills 6 to 8 feet high, rising to heights of 20 to 30 feet towards Nizámpatam.

Beacons.—A beacon is situated about half a mile inland at the southern part of the outlets of the Gundlakamma river.

Beacons are also charted on the shore, at about 9½ miles north-north-east, and 20 miles north-east of the beacon near Gundlakamma river entrance, at the head of the bay southward of Nizámpatam, and another 6½ miles eastward of it.

NIZÁMPATAM, the principal town on the shores of the bay, is approached by creeks, in which there is always water enough for boats, and at high water enough for small vessels.

Entrance.—The deepest entrance to the creek leading to Nizámpatam is opposite a large white sandhill eastward of Dindi house, but there is another channel opposite Dindi house which can be used by ships' boats at any time but low water springs. Westward of and inside the entrance is a conspicuous clump about 60 feet high.

Dindi house is a large house on the beach at the entrance to the creek leading to Nizámpatam; close to the house is a big tree, the top of which is 67 feet high.

Anchorage.—There is open anchorage in a depth of 5 fathoms, over mud, with Dindi house and tree bearing N. by E. ⅞ E., distant about 6 miles.

Tides and tidal streams.—It is high water, full and change, at Nizámpatam entrance at 9h. 0m.; springs rise 4⅓ feet, and neaps

3½ feet. The tidal streams are weak and only felt in-shore and at springs.

Town (*Lat. 15° 54′ N., Long. 80° 40′ E.*).—Nizámpatam was the first place on the east coast where the British commenced to trade, and a factory was established in 1621; its population in 1901 was 4,216.

Supplies.—Fowls and eggs in limited quantities can be obtained, also sheep, and fish in abundance, but no vegetables.

Trade.—Rice is exported to Negapatam and southern ports, timber is occasionally imported from Rangoon, and salt is sent up country by canal. The trade was valued at 21 lakhs in 1908.

COAST.—The coast from Dindi house trends eastward for a distance of 5 miles to the entrance of a creek, navigable by boats, then south-eastward and southward to False Point Divi.

Backwater.—North of False Point Divi is a considerable backwater formed by a long spit, which, commencing 2½ miles north of False Point Divi, extends 4 miles northward, enclosing a sheet of water half a mile broad, and leaving an entrance at the north end. This backwater is connected by creeks with Kistna river.

FALSE POINT DIVI, distant 12¼ miles south-eastward from Nizámpatam river entrance, is low and covered with small mangrove jungle.

Shoal ground, which dries in patches, extends one mile southward and 3 miles westward of the point.

Caution.—The 5-fathoms contour line lies 4½ miles, and the 10-fathoms line 5½ miles, from the land; the top of the trees are just visible from the 10-fathoms line. As the soundings decrease rapidly from the 100-fathoms contour line, the lead must be kept going, and the land not approached nearer than a depth of 20 fathoms.

Currents.—There is scarcely any current in Nizámpatam bay. The current off Fals Point Divi sets to leeward, according to the monsoon, and parallel to the shore, being strongest near the 100-fathoms contour line.

KISTNA DISTRICT is eastward of that of Guntur, and has a coastline of about 55 miles; the principal port is Masulipatam. *See* Chapter I., page 19.

Kistna river rises about 40 miles from the Western Gháts at Mahabaleshwar in the Bombay Presidency, flows eastward across the peninsula of India, and after a course of about 800 miles, falls into the Bay of Bengal by several branches, the mouth of one being near False Point Divi; the western bank is in Guntur, and the eastern in Kistna district.

The enormous amount of silt carried by the river has deposited and formed a wide alluvial delta, which extends seaward; at Bezwada, at the head of this delta, a large masonry dam crosses the river and turns it into a network of irrigation channels spreading throughout the delta, and immediately below the dam the river is crossed by the East Coast line of the Madras railway on a 12-span girder bridge.

The river is too rapid for navigation above the dam, but between Bezwada and the mouth sea-going native craft use it for about six months of the year; the main irrigation channels are also navigable.

The coast trends east-north-eastward for 11 miles from False Point Divi, and then turns northward, forming a bay as far as Divi point. It is low and monotonous, with a sandy foreshore and occasional low sandhills, backed by a fringe of jungle, 30 to 40 feet high.

KISTNA.—LIGHT (*Lat. 15° 47′ N., Long. 80° 59′ E.*).—A masonry tower, 144 feet in height and painted white, situated on the south-east point of the delta, exhibits, at an elevation of 140 feet above high water, a *white group flashing* light, with a period of system of *ten seconds*, showing two flashes, occupying *two and a half seconds*, followed by an interval of *seven and a half seconds;* it should be visible in clear weather from a distance of 18 miles.

DIVI POINT, about a mile eastward of the eastern mouth of Kistna river, is low and sandy, with a little scrub. Depths of less than 3 fathoms extend nearly 2 miles from the point, and there are only 5 fathoms at 4 miles off.

Landmark.—An old lighthouse, a white masonry tower, 50 feet high, situated on the left bank of the river near Divi point, is maintained as a landmark.

Current.—In March the current off Divi point has been found setting eastward at a rate of 1½ miles an hour.

Directions.—Vessels bound eastward from Nizámpatam should be guided entirely by the lead, and not approach the coast nearer than a depth of 6 fathoms by day. Between False Point Divi and Divi point the water should not be shoaled to less than 8 fathoms. By night, approach the coast with great caution, as the bank of soundings extends but a few miles seaward. Even by day the lead must be used, as the coast is very low, and frequently obscured by haze.

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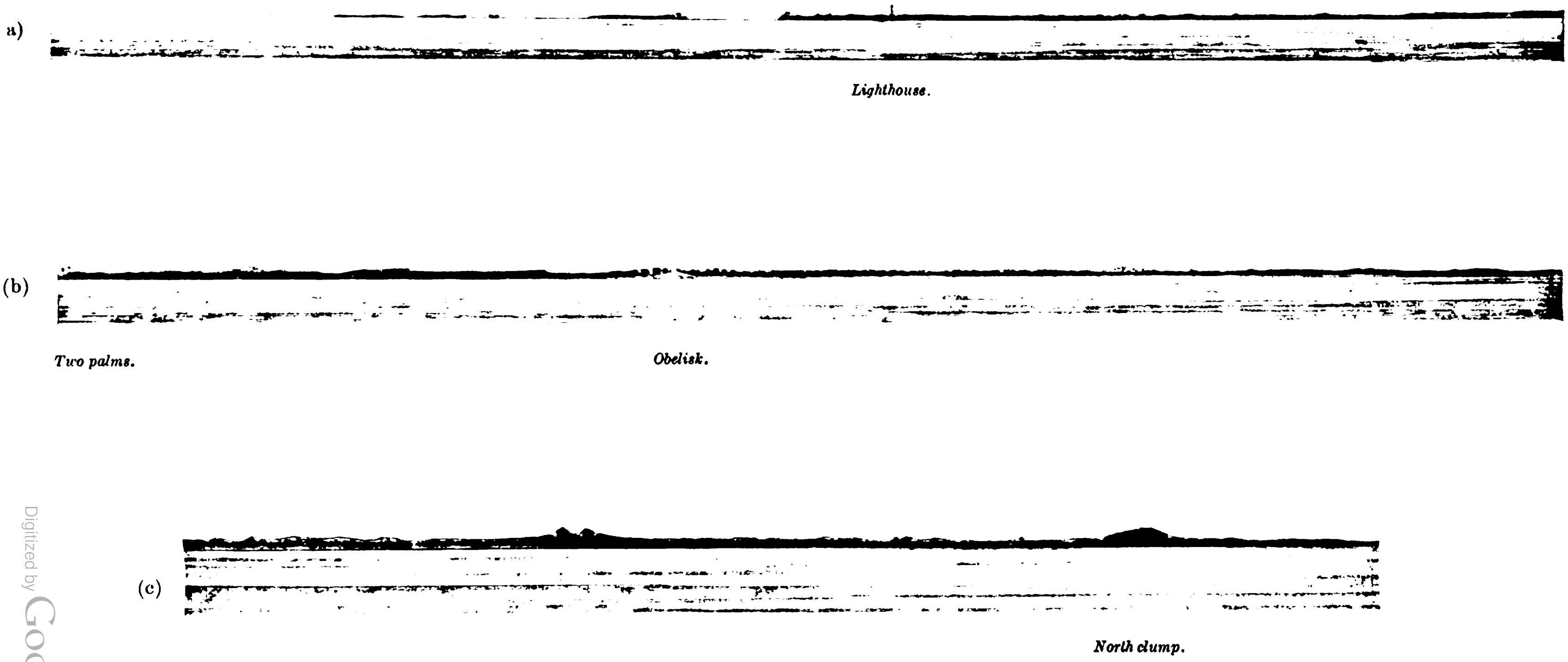
ace page 237.]



Masulipatam and coast to the northward, from the anchorage.

Plan of Masulipatam roads on 1894. Var. 0° 20′ E.

MASULIPATAM, on a branch of Kistna river, is the chief port of Kistna district, but of small commercial importance, the greater part of the trade finding its way to Cocanada. In 1864 a tidal wave destroyed a great part of the town, and 30,000 persons perished.

The Fort is now only the name of the locality near the flagstaff, which is 112 feet high; the port office is about 300 yards from the flagstaff. The entrance to the canal is near the Fort.

LIGHT (*Lat. 16° 10′ N., Long. 81° 11′ E.*).—A masonry tower, 43 feet in height and painted white, situated on the coast immediately northward of Masulipatam river entrance, exhibits, at an elevation of 33 feet above high water, a *white group occulting* light, with a period of system of *one minute,* showing four eclipses, each of *five and a half seconds' duration,* separated by intervals of *six seconds,* and followed by an interval of *twenty seconds;* the light should, in clear weather, be visible from a distance of 11 miles. (View *a,* page 237.)

Buoy.—A conical buoy, painted black, is moored in a depth of 3½ fathoms 5¾ miles eastward of the flagstaff; it marks the position for boats to wait outside the bar in order to communicate with vessels approaching the port.

Anchorage.—The anchorage, in a depth of 4½ fathoms, is about one mile south-eastward of the black buoy, with the flagstaff bearing W. ⅜ N., distant nearly 6½ miles. The roadstead is capacious, and has good holding ground; but during the North-east monsoon, with a ground swell, communication with the shore is tedious and uncertain. The limits of the port are marked by boundary pillars. Ballast may not be thrown overboard in less than 10 fathoms of water.

Directions.—Bound to Masulipatam from the southward, make False Point Divi, and stand north-eastward, keeping in not less than 8 fathoms. On passing Divi point the fort flagstaff will be visible, and soon afterwards the clumps of trees northward of Masulipatam river mouth. When the flagstaff bears about W.N.W., steer for the anchorage, keeping the lead going.

In June, July, and August, sailing vessels should make Divi point by daylight, and hug the coast as close as prudence will permit, as westerly winds are frequently very strong during the South-west monsoon, when it is necessary to beat into the anchorage, which is tedious owing to the freshets setting off the land.

During the North-east monsoon, vessels should invariably make Narasapur point, and then steer for the anchorage.

The river mouth, near which Masulipatam is situated, has a bar on which the depth is about one foot during the dry

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Plan of Masulipatam roads on 1894. Var. 0° 20′ E.

season. During October, November, and December boats are occasionally, but not often, unable, owing to the weather, to cross the bar and communicate with shipping. Cargo boats proceed up the river for a distance of about 4 miles to discharge at the wharf in the port, or go on by canal to Bezwada, on the main channel of the Kistna river.

Storm signals are shown at Masulipatam; *see* pages 74-76.

Signals.—When communication with the shore is dangerous, owing to surf on the bar, a red and white chequered flag is hoisted at the flagstaff of the fort. When the surf becomes impassable, a white pendant with a red ball is hoisted under that flag.

At night, three lights hoisted horizontally by a vessel indicate that a boat is urgently required; blue lights burnt and guns fired indicate fire or danger.

Tides.—It is high water, full and change, at Masulipatam, at 9h. 15m.; springs rise about 5¼ feet, neaps about 3¼ feet.

Town (*Lat. 16° 11′ N., Long. 81° 11′ E.*).—The town consists of three parts, the fort, the native quarter, and the European quarter, and of these the fort is almost non-existent. Around the fort is a vast expanse of waste land, which is swamp in the rainy season, but firmer in summer, and across it a causeway about 2 miles in length leads to the native town.

Northward of the native quarter, and along a sandy ridge, are the houses of European residents; in 1901, the population was 39,507, but, unless affected by a new railway to be constructed from Bezwada, it is not likely ever to have much commercial importance. A tidal wave, in which about 30,000 people perished caused great destruction to the town in 1864.

Communication.—There is weekly communication by steam vessels of the British India Company, with Madras and Rangoon, and fortnightly with Calcutta and Bombay.

The nearest railway station is at Bezwada, which is 48 miles by road and canal from Masulipatam, and connected with the Indian railway system; the canal is closed annually from March to May inclusive. Masulipatam has telegraphic communication.

Hospital.—There is a civil hospital and dispensary.

Supplies.—Fresh meat and bread may be procured in small quantities, but vegetables are very scarce; the drinking water, shipped in casks, is not good.

Trade.—Shipping.—The exports are paddy, hides, and grain, and the imports piece goods, twist, metals in manufactured state, and cement.

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Plan of Masulipatam roads on 1894. Var. 0° 20′ E.

Climate.—The climate of Masulipatam is hot and dry, nearly all the rain falling in the South-west monsoon between June and October. *See* Meteorological table in Appendix, page 575.

Chart 1894, Ramapatnam to Narasapur point.

COAST.—From Masulipatam the coast curves in a north-eastward and eastward direction for about 32 miles to Narasapur point, and is low, sandy, and thickly wooded for 8 or 9 miles from Masulipatam, after which the trees are more scattered for about 10 miles, when they become thicker to Narasapur point. At three-quarters of a mile northward of Masulipatam river mouth are two clumps of casuarina trees, long and wedge-shaped, the northern ends being the highest.

About 3½ miles further northward is a small pointed clump, and rather more than a mile northward of that, and close to the coast, is North clump, which is large, very compact, about 60 feet high, and often appears like an island, the trees northward and southward of it being of a lighter colour. (View *c*, page 237.)

Obelisk and beacon (*Lat. 16° 11′ N., Long. 81° 11′ E.*).—An obelisk, about 60 feet above high water, stands on a sandhill about a mile north-westward of the southern casuarina clump. (View *b*, page 232.)

A beacon about 20 feet high is situated on the coast about 11 miles north-eastward of Masulipatam. Neither are conspicuous.

Wupputer river flows into the sea 25 miles east-north-eastward of Masulipatam.

Depths off-shore.—The coast between Masulipatam and Narasapur point may be approached with care to 7 fathoms, which depth is generally about 5 miles off it.

NARASAPUR POINT, the eastern entrance point of Vasishta Godávari river, is low, woody, and situated 37 miles north-eastward of Divi point.

Narasapur point should not be approached to less than 7 fathoms by day, nor 20 fathoms by night; the 20-fathoms contour line is about 8 miles from it.

Obelisk.—An obelisk, 80 feet in height, stands nearly a mile northward of the point.

Depths.—Vasishta Godávari river, which is the northern mouth of the Godávari, has about 7 feet at low water on its bar, which extends nearly 2 miles southward of the point, with 2 to 3 fathoms inside. The channel leading into the river is between two sandbanks, on which the sea breaks. It divides the districts of Kistna and Godávari.

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Chart 1894, Ramapatnam to Narasapur point. Var. 0° 20′ E.

Town (*Lat. 16° 26′ N., Long. 81° 42′ E.*).—Narasapur town, situated 8 miles up the river, has a celebrated Hindu shrine, visited once a year during a five days' festival by some 20,000 pilgrims; its trade has almost ceased. Boat building was once carried on, and native craft still resort to it for repairs; the population is about 7,000.

Communication.—There is a post and telegraph office at Narasapur.

Supplies of provisions may be procured at moderate cost.

Current.—In the bay westward of Narasapur point the current is weak and variable.

GODÁVARI DISTRICT commences at Wupputer river, about 9 miles westward of Vasishta Godávari river mouth, and has about 70 miles of coastline; it has four British ports or roadsteads—Bandarmalanka, Coringa, Cocanada, and Upada. Besides these, Yanám or Yanaon, a small French settlement, stands 5½ miles southward of Coringa, at the point where Coringa river issues from the Godávari. *See* Chapter I., page 22.

Chart 1711, Narasapur point to Bimlipatam. Var. 0° 30′ E.

COAST.—From Narasapur point the coast trends for 15 miles in an east-north-east direction to the mouth of Vanteyam Godávari river, and is low, but thickly wooded. The entrance of the Vanteyam Godávari is named Warreo, and off it a shoal spit forms during freshets. Two large and conspicuous clumps of casuarina trees are situated on the eastern bank, near the mouth of the river. This coast may be approached to a depth of 10 fathoms; the 100-fathoms contour line is about 9 to 14 miles off-shore.

Beacon.—A pole beacon, 26 feet high, marks the entrance to the river.

Current.—In January and February the current at about 9 miles off the coast, between Narasapur point and the Vanteyam Godávari, runs westward at a greatest rate of 2 knots.

Coast.—From the entrance of the Vanteyam Godávari river the coast trends in an east-north-east direction for 23 miles to the mouth of Vrudha Gautami river, which is the southern entrance to the Gautami Godávari, the principal entrance.

The strong current has cut a channel, 5 to 10 fathoms in depth, through the alluvial soil, and the river is joined near its mouth by two feeders, which together make an out-going stream running at the rate of 4 knots in the wet season. As the stream issues it is met by the swell always running on this coast, and two shoals have formed off the mouth of the river, the southern being Sacramento shoal.

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Chart 1711, Narasapur point to Bimlipatam. Var. 0° 30′ E.

Beacon.—About 1½ miles south-westward of the river entrance, and half a mile inland, is Kotapalem beacon, a pole 40 feet above high water.

LIGHT (*Lat. 16° 35′ N., Long. 82° 17′ E.*).—From a masonry tower, 148 feet in height, near Kotapalem beacon, a *white flashing* light, with a period of system of *five seconds*, is exhibited, at an elevation of 140 feet above high water; the flash occupies *one-tenth of a second*, and the light should be visible, in clear weather, from a distance of 18 miles.

SACRAMENTO SHOAL, consisting of hard sand, is the extreme detached portion of the southern of the two shoals above mentioned; its outer edge is 2 miles from the line of coast. There are depths of 6 fathoms close outside it, and the 10-fathoms contour line is about 1¾ miles to the eastward. The shoal nearly dries and the sea always breaks on it, except at its outer edge.

Shoal water extends nearly 1½ miles from the shore southward, 3 miles eastward, and 2½ miles north-eastward from the lighthouse. Thirthalmundi village, with huts on the coast, is situated about 5½ miles northward of Sacramento shoal.

Beacon.—A beacon, 32 feet in height and painted white, is situated at Thirthalmundi village.

Clearing mark.—Thirthalmundi beacon, bearing N. by W. leads one mile eastward of Sacramento shoal.

Anchorage.—Northward of the shoals there is anchorage in a depth of 4 fathoms, over mud, nearly one mile off-shore, with shelter from winds between S.S.E., through west, and N.N.W. In rounding the shoals, give them a berth of a mile.

Vrudha Gautami river.—Depth.—The least water in the channel over the bar is 9 feet at low water springs.

Directions.—Small craft can enter in fine weather, but sailing vessels require a fair wind. Steer about S.W. ½ W. in mid-channel over the bar, between the two lines of breakers, and when within Sacramento shoal keep north-westward towards the single tree, which, in 1891, stood near the river mouth, following the line of the northern shoal at 2 cables distance until in the river. Inside the bar the water deepens to 4 and 6 fathoms.

Tides.—It is high water, full and change, at Sacramento shoal at 9h. 15m., springs rise 5¼ feet; neaps rise 3¼ feet. At neaps the tide is about half an hour earlier than at Cocanada.

Current.—During the months of January to April inclusive a current runs steadily to the north-eastward at a short distance from

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the shore, in the vicinity of Sacramento shoal; its velocity is greatest, sometimes 4 knots, at a distance of 5 miles from the shore.

Between Cocanada and Bimlipatam its distance from the shore is greater, and its velocity less; in-shore of the current slack water is generally found, but sometimes close in-shore the tidal stream will be experienced.

COAST.—Between Vrudha Gautami river mouth and Godávari point, about 20 miles to the northward, the coast is very low. In this vicinity distances judged by eye are likely to be erroneous, owing to the sand haze. Bahiraswami temple is 4½ miles northward of Kotapalem; and 2 miles further northward is Thirthalmundi village, situated on a mound, with the obelisk already mentioned on the beach. There are several sandhills between the mouth of Vrudha Gautami and Thirthalmundi, but none northward of that village. A small break in the coast occurs 2½ miles northward of Thirthalmundi.

Hope island is low, swampy, covered with jungle, and, being only 3 feet above high water, is submerged during high tides. It is one of a broken chain of similar islands, and part of the delta of Godávari river.

Godávari point (*Lat. 16° 57′ N., Long. 82° 22′ E.*), the southern point of Cocanada bay, is the northern end of a series of narrow banks extending northward from Thirthalmundi, and forming the coast; they are low, sandy, and covered in places with small scrub, and the sea breaks heavily on them during the South-west monsoon. The point, which is reported to have extended one mile west-north-westward, dries soon after half ebb; and the entrance to Godávari river is westward of it; both the point and the entrance are also known as Gordeware.

Buoy.—A black pillar buoy is moored in 7 fathoms water at about 1$\frac{2}{10}$ miles north-east of Godávari point. The position of this buoy cannot always be depended upon.

Depths off-shore.—Between Sacramento shoal and Godávari point the soundings are regular; the 10-fathoms contour line being 1½ miles from the outer edge of Sacramento shoal, 2½ miles from the coast off Thirthalmundi, and 2 miles outside Godávari point.

CHAPTER V.

ORISSA COAST.—COCANADA TO FALSE POINT AND DHAMRA RIVER.

(Lat. 16° 57′ N. to lat. 20° 46′ N.)
(Long. 82° 17′ E. to long. 86° 43′ E.)
VARIATION: Decreasing about 3° annually.

Plan of Coringa or Cocanada bay on 1711. Var. 0° 30′ E.

COCANADA (*Lat. 16° 57′ N., Long. 82° 17′ E.*), situated on the shore of Coringa bay, about 7 miles westward of Godávari point, stands on the banks of a small river, which is connected with Samalkot and Rajahmundry canals, the latter, 32 miles in length, joining the Godávari river at a town named Dowlaishweram, and is the principal seaport of Godávari district, as well as the safest natural port on the eastern coast of India.

Two piers or groines extend from the mouth of Cocanada river, and a channel of sufficient depth to enable cargo boats to communicate with shipping at all times of tide is preserved by dredging. The limits of the port are defined on shore by boundary pillars, and extend seaward to 13 fathoms water; no ballast is permitted to be thrown overboard in a less depth than 12 fathoms.

On the north bank of the river, and about a quarter of a mile from the sea, is an old lighthouse tower, 80 feet high, and painted black; nearly half a mile westward of the tower is the port office.

Extensive quays extend the entire length of the tidal creek, opposite the merchants' offices, and there are greatly improved facilities for working cargo.

COCANADA BAY is shallow, with extensive mud flats, which dry at low water extending off the mouths of Godávari river. The bay has been silting up for many years, the shoals, formed by the deposit brought down by Godávari river, having advanced, and in 1903 the bay was found to have shoaled from 2 to 3 feet. The shores of the bay are low and liable to periodical inundations during cyclonic storms.

LIGHT.—At Vakalapudi, a quarter of a mile inland on the west side of Cocanada bay, and nearly 5 miles northward of Cocanada river entrance, is a column, 76 feet in height and painted white, which exhibits, at an elevation of 80 feet above high water, a *white group*

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flashing light, with a period of system of *ten seconds*, showing three flashes, occupying *four seconds*, followed by an interval of *six seconds;* it should be visible in clear weather from a distance of 14 miles.

Signal station.—Vakalapudi lighthouse is in telephonic communication with Cocanada port office, and is a signal station.

Storm signals are shown from Vakalapudi lighthouse. *See* pages 74-76.

Harbour lights (*Lat. 16° 57′ N., Long. 82° 16′ E.*).—On the pier ends at Cocanada river entrance, two *red fixed* lights are exhibited at 10 feet above high water, which should be seen from a distance of about 2 miles in clear weather. These lights are shown as guides to boats entering or leaving the river.

Buoys.—A large pillar buoy, painted black, is moored in 7 fathoms water about $1\frac{2}{10}$ miles north-eastward of Godávari point.

A conical buoy, painted red, with a white top, is moored about 2½ miles west-north-west of Godávari point, as a mark for discharging dredgings.

Anchorage.—The anchorage, in from 4 to 5 fathoms off Cocanada, with Vakalapudi lighthouse bearing N.W. ½ N., and the old lighthouse about S.W. by W. ⅛ W., is safe, with a soft bottom, and good holding ground. Vessels lie here at all seasons, and, although about 4 miles from Cocanada river entrance, yet, owing to the sea in the bay being generally smooth, communication with the shipping and the shore is rarely impeded.

There is also anchorage in about 4½ fathoms, with Vakalapudi lighthouse bearing N.W. ¼ N., distant about $1\frac{4}{10}$ miles, but less water may be obtained in these positions as the bay is gradually silting up. Although open to winds from north-north-east to east-south-east, vessels do not put to sea from here on the approach of bad weather, and should a vessel be driven from her anchors the soft muddy bottom prevents serious damage.

GODÁVARI RIVER rises about 70 miles north-eastward of Bombay, traverses the peninsula in an easterly direction, and is about 900 miles in length, with a breadth in places during the rainy season of 1½ miles; its northern and principal mouth is about 7 miles eastward of Cocanada.

The main channel into Godávari river, westward of Godávari point, has a depth of about one foot at low water on the bar, and deepens inside. Lanes are cut through the jungle from the western side of the channel near Hope island towards the town of Coringa. The entrance to Coringa river, which is very shallow, is about 3½ miles southward of Cocanada river entrance, and a road connects Coringa and Cocanada towns.

Coringa (*Lat. 16° 49′ N., Long. 82° 14′ E.*) is a closed port, the channel through the flats leading to the river having only from one foot to 2 feet at low water. At about 5½ miles southward of Coringa is the French settlement of Yanám or Yanaon.

Tugs.—Two tugs are available.

Directions.—A sailing vessel from the southward bound to Cocanada in the South-west monsoon should make the land in about latitude 16° 30′ N., and thence run along the coast in a depth of not less than 10 fathoms. Care is necessary in passing Sacramento shoal (*see* page 241). The pillar buoy north-eastward of the point may be seen, but until Vakalapudi lighthouse bears W.N.W. the water should not be shoaled to less than 10 fathoms, when steer for the anchorage.

Working into the anchorage in the South-west monsoon, do not stand further south-westward in the bay than a depth of 6 fathoms at low water; the lead must be constantly used, as the water shoals rapidly, and the depths may be less than charted.

During the North-east monsoon, make the land at about Pentakota, 30 miles north-eastward of Cocanada, and then steer along the coast in a depth of 12 fathoms. When Vakalapudi lighthouse bears about W.S.W., steer for the anchorage. Northward of Cocanada the land appears bold, with high land extending away north-eastward; southward of Cocanada the coast is low and sandy, interspersed with a few sandy hillocks, palmyra trees or low jungle.

At night, from the southward care is necessary; the lead should be kept going, and the water should not be shoaled to a less depth than 12 fathoms. When Vakalapudi light bears W.N.W. steer for it on that bearing and anchor in 7 to 8 fathoms.

From the northward, during the North-east monsoon, approach with Vakalapudi light bearing W.S.W.; when in 10 fathoms water and the light distant 9 miles, steer about S.W. ¾ W., and on the depth decreasing to 7 or 8 fathoms anchor with the Vakalapudi light bearing W.N.W., distant about 3 miles.

Tides.—It is high water, full and change, at Cocanada, at 8h. 50m.; springs rise 5¼ feet, neaps 3¼ feet; neaps range 1⅓ feet. The tides are irregular, and greatly influenced by the wind and the freshets out of Godávari river.

The tides are subject also to diurnal inequality, which may accelerate or retard the times of high and low water, and increase or diminish the rise by, at times, as much as one foot.

Plan of Coringa or Cocanada bay on 1711. Var. 0° 30′ E.

Tidal streams.—The tidal stream sets north-eastward during the falling tide, south-westward during the rising tide. The tidal streams at springs are strong, especially from October to February, and must be taken into account when closing the land.

At the anchorage there is very little tidal stream; it is usually slack during the rising tide, and sets north-eastward during the falling.

Town (*Lat. 16° 57′ N., Long. 82° 14′ E.*).—Cocanada town, situated on a sandy plain a little above sea level at the head of Cocanada bay, is the head-quarters of the district administration and the chief port on the Coromandel coast northward of Madras, but, owing to the bay silting, its trade has declined; in 1901 the population was 48,096. There is a large European community, and most foreign governments are represented by consular agencies. It has a salt factory, a large rice-husking mill, several oil factories, an iron foundry, and cheroot manufactory.

Communication.—The British India Company's steam vessels from Rangoon call weekly, and those running between Bombay and Calcutta fortnightly; the Asiatic S.N. Company and Clan line have a regular service of steamers. A branch railway runs from Cocanada port to Samalkot, 391 miles from Madras, where it connects with the East Coast railway, and there is telegraphic communication.

Coal and supplies.—A very small quantity of coal is kept in stock, as the amount annually imported is only 500 tons, but a large supply may be obtained on short notice; two wharves, each 25 feet in length, have a depth of 4 feet alongside. Eighteen lighters of an aggregate capacity of 430 tons are available, and 250 tons of coal could be put on board in 24 hours.

Fresh provisions are plentiful and fairly cheap, and water can be supplied alongside in iron tanks. Marine stores or salt provisions can be obtained. Water is obtained from the Samalkot canal, the waterworks, completed in 1903, giving a supply of 10 gallons per head to a population of 40,000.

Repairs.—Small repairs can be executed by the Public Works Department at Dowlaishweram, 32 miles by canal from Cocanada.

There is a steam crane capable of lifting 12 tons, and also a pair of sheers to lift 7 tons, on Cocanada wharf.

Hospital, &c.—There is a seamen's hospital at Cocanada. Beri beri disease is endemic, but is mostly confined to natives.

Trade.—The principal exports are cotton, oilseeds, rice, tobacco, pulses, and gingelly oils, piece goods, twist, yarn, gunny bags, rice, and kerosene oil. The imports are sugar, oils, metals, yarns, and textile fabrics; in the year 1908-09 the former were valued at Rs. 95,33,002, and the latter at Rs. 10,57,380.

In 1903 the port was entered by 265 vessels, of 534,545 aggregate tonnage.

General charts 829, 70.

Chart 1711, Narasapur point to Bimlipatam. Var. 0° 30′ E.

Current.—From about August to November the current sets south-westward, and from about the middle of December until July it sets north-eastward at a short distance from the land between Sacramento shoal and Bimlipatam.

From January to April, both inclusive, it attains its greatest rate, sometimes as much as 4 knots an hour, in the vicinity of Sacramento shoal and about 5 miles from the land; between Cocanada and Bimlipatam it extends further off-shore with a less rate; in-shore of the current there is generally slack water.

In July and August its rate is less than one knot. This current also prevails off the coast north-eastward to False point, but is not so strong as off Cocanada bay.

COAST.—From Vakalapudi lighthouse the coast, trending in a north-east direction, is low for about 10 miles, with numerous villages and cocoanut trees. Low sandhills then commence and continue to Pentakota, a further distance of 15 miles. At 5½ miles north-eastward from Vakalapudi lighthouse is Upada, a small port for native craft.

Beacon.—At Wontimaudi, nearly 12 miles north-eastward of Upada, there is a masonry beacon on a sandhill close to the coast, but it is not easily seen.

Depths off-shore.—The 10-fathoms contour line, which is about 5 miles eastward of Vakalapudi, gradually approaches the coast, and is nearly 3 miles south-eastward of Pentakota.

Round hill, a mountain, 2,143 feet high, and 26 miles northward of Cocanada, shows well from near Cocanada in clear weather.

VIZAGAPATAM DISTRICT, commencing about 3 miles south-west of Pentakota, has a coast line of nearly 100 miles, and includes the ports of Vizagapatam and Bimlipatam. *See* Chapter I., page 24.

Pentakota (*Lat. 17° 18′ N., Long. 82° 37′ E.*), 30 miles north-eastward of Cocanada, is situated in the southern part of Vizagapatam district, and at the mouth of a river; it has a post office and Custom-house, but is not now visited by shipping.

A heavy sea rolls in during the South-west monsoon, when the river is closed; during the North-east monsoon the river is open.

At the entrance to the river are two sandhills of moderate height, and a cocoanut grove close to them.

Aspect.—Sudikonda, 3 miles northward of Pentakota river entrance, is a cone-shaped hill 523 feet high; although not the highest hill in the vicinity, it is the most conspicuous, owing to its form and colour; and shows well from seaward when bearing northward of W. by N.

General charts 829, 70.

Chart 1711, Narasapur point to Bimlipatam. Var. 6° 30′ E.

Túni hill (not named on chart), 8 miles from Pentakota river mouth, is conical and a good landmark.

COAST.—From Pentakota to Vizagapatam the coast trends in a north-east succession of rounded hills, rising from a low sandy plain. These hills show well at night.

Beacons.—Dongalkonda is a conspicuous white obelisk, on smooth rising ground half a mile inland, and 4 miles north-eastward of Pentakota. Polarem, a small but very conspicuous rocky eminence, 72 feet high, on the beach 13 miles north-eastward of Pentakota, is surmounted by a beacon 15 feet in height.

Sanjib peak, remarkable and conical with a somewhat flattened and broken summit, is 2,139 feet high, and situated 11 miles north-westward of Polarem.

The Orissa or Orixa coast commences southward of Wattara, extending thence to Húgli river entrance, but the southern part of this coast is generally known as the Northern Circars, and the name Orissa is applied to that northward of Ganjam.

Wattara (*Lat. 17° 25′ N., Long. 82° 52′ E.*), nearly 7 miles north-eastward of Pentakota, is situated on a tableland at the south entrance point of a small bight formed at the mouth of three small rivers. The entrance is almost entirely blocked at low water.

Rambhil, a remarkable round hill, 606 feet high, situated 4 miles north-eastward of Wattara, presents a steep face to seaward; it is surmounted by a beacon 16 feet in height.

Pudimadaka, about 8 miles north-eastward of Wattara, is a small village on the shore of a bight about half a mile in extent. Pillar rock, a rocky islet, 30 feet high, situated south-south-eastward of the village and about 3 cables off-shore, and some dark cliffs on the coast near it, show conspicuously on the white sandy beach.

Pillar rock has about 5 fathoms near it to seaward, and a ledge of rocks which serves as a breakwater during the South-west monsoon lies between it and the coast, so vessels then can load with facility. A small export trade is carried on from Pudimadaka.

Depths off-shore.—The 10-fathoms contour line is only three-quarters of a mile outside Pillar rock.

Anchorage.—There is anchorage during the South-west monsoon in 5 fathoms with Pillar rock bearing about S.W. by S., and the godowns on the beach W. by N.; but, during the North-east monsoon, the anchorage for a sailing vessel is further from the shore, in 7 or 8 fathoms, so as to give Pillar rock a wide berth in case of being compelled to get under weigh.

General charts 829, 70.

Chart 1711, Narasapur point to Bimlipatam. Var. 6° 30′ E.

COAST.—From Pudimadaka the coast trends in a north-east direction, curving outward slightly, for about 21 miles to Vizagapatam; it is broken and rocky, but no rocks extend more than 3 cables from it, and the 20 fathoms contour line is from 4 miles to 1¾ miles from the beach.

The coast is backed by a plain studded with hills, and the sand has drifted so high on the south-western sides of some of them near the coast that they are conspicuous.

A rock, about 4 miles north-eastward of Pillar rock, appears from the northward as a low black double rock on the sandy beach. The coast immediately north and south of it is sandy, with a few scattered rocks along the beach.

Kutkonda (*Lat. 17° 34′ N., Long. 83° 10′ E.*), 10½ miles north-eastward of Pillar rock, is a small conspicuous rocky promontory, 145 feet high.

Beacon.—A beacon, 15 feet in height, stands on Kutkonda.

Pigeon islet, half a mile off-shore in a small bay, 5 miles north-eastward of Kutkonda, is small, rocky, and 82 feet high.

Yarada mountain, 3 miles northward of Pigeon island, is 1,174 feet high, slopes gradually towards the coast, and terminates abruptly eastward in Dolphin's nose, a bluff headland, 536 feet in height, with a masonry tower and flagstaff on its summit, and several houses on its north side.

Plan of Vizagapatam on 239.

VIZAGAPATAM is a seaport with many natural advantages, and with an increasing trade; the river which separates the town from Dolphin's nose, is barred at its entrance, and only capable of admitting boats and small steam launches.

A scheme for dredging the backwater and river, and forming an inner harbour and docks, is proposed, which would probably render it the finest harbour on the coast, enabling sea-going vessels to go alongside the docks.

The limits of the port are defined by boundary pillars.

LIGHT.—A *white fixed* light is exhibited, at an elevation of 73 feet above high water, from a masonry tower, 59 feet in height, situated near the fort flagstaff; it should be visible in clear weather from a distance of 14 miles.

Storm signals are shown at Vizagapatam. *See* pages 74-76.

Anchorage.—The best position is in about 5 fathoms water, over sand, with Vizagapatam fort flagstaff bearing W. by N. ⅝ N., and the flagstaff on Dolphin's nose S.W. ⅛ S. Care must be taken in anchoring, as the soundings shoal quickly, and the stern of a large vessel anchoring in 6 fathoms might swing into 4½ fathoms at low water. The bottom inside the 3-fathoms line northward of the town is foul.

Directions.—Dolphin's nose, though a remarkable headland when approached from along the coast north-eastward or south-westward, is not readily made out from the high land beyond it, when viewed from a distance seaward. In making Vizagapatam during the North-east monsoon, endeavour to sight Rusi or Sugarloaf hill (*see* page 251); from the southward, make Pigeon islet.

Maonderu river drains the high land on which Vizagapatam is situated and discharges into the small bight immediately north of Dolphin's nose. The bar, which has a depth of five feet over it at low water spring tides, is dangerous, and can only be crossed in ships' boats in fine weather and during southerly winds. Mud docks for native craft are situated about a mile up the river.

Tides.—It is high water, full and change, at Vizagapatam, at 8h. 26m.; springs rise 5¼ feet, and neaps 3½ feet; neaps range one foot. The tides are subject to diurnal inequality, which may accelerate or retard the times of high and low water, and increase or diminish the rise by, at times, one foot.

Town (*Lat. 17° 43′ N., Long. 83° 18′ E.*).—Vizagapatam, besides being the head-quarters of the usual district staff, is the residence of the controlling officers in the several departments, and is a flourishing seaport. On the west of the town is a large backwater, from which a small stream runs to the sea, and on the north and south are two parallel ridges of low hills about 1,800 feet high and 4 miles apart. A British factory was established at Vizagapatam in 1687. In 1901 the population was 40,892.

Waltair, about 2½ miles north-eastward and a suburb of Vizagapatam, pleasantly situated on a ridge of low hills facing the sea, is the head military quarters of the district, where most of the Europeans reside.

Communication.—There is a weekly communication with Madras, Rangoon, and coast ports, and fortnightly with Bombay and Calcutta, by steamers of the British India Company. The Asiatic line have a fortnightly service to Calcutta and Bombay, *viâ* coast. There is a regular weekly service of Clan line steamers to London and the Continent, taking manganese ore and jaggery. Occasionally vessels are chartered to take manganese ore to the United States.

A branch railway runs from Vizagapatam to Waltair, where it connects with the East Coast railway. Vizagapatam has telegraphic communication.

Plan of Vizagapatam on 239. Var. 0° 30′ E.

Supplies.—Fresh meat, bread, and vegetables may be procured at reasonable rates; the water good, and may be obtained from the Port officer, but it runs very slowly.

Repairs.—The railway would undertake repairs to hull or machinery of vessels if required.

Landing.—There is a landing and shipping platform at Vizagapatam wharf, with railway connections.

Hospital.—The Civil hospital will accommodate 77 patients, and there is a dispensary where Lascars may be treated.

Trade.—The principal exports are manganese ore, raw sugar, hides, skins, myrabolams, and indigo; and imports, cotton twist, yarn, piece goods, iron, and timber; the former are valued at about 4,000,000 rupees, and the latter at 2,665,000 rupees.

Winds.—From March to June, south-west winds prevail; in July and August, north-west; in September, westerly; and from October to December, north-east. In the latter months, north-east winds are fresh during the day, with light westerly winds at night. Heavy squalls with rain occur in October and November.

Waltair point (*Lat. 17° 44′ N., Long. 83° 20′ E.*), about 4 miles north-eastward of Vizagapatam, is low and sandy with a rocky foreshore, and red sandhills which are at times conspicuous from the offing. On the point is a house in ruins, with a grove of palm trees behind it, and the north boundary of the port of Vizagapatam is close southward of this. The bottom, within a depth of 8 fathoms, is foul, and vessels should not anchor near the point.

Chart 1711, Narasapur point to Bimlipatam.

COAST.—From Waltair point the coast trends in a north-east direction for 12 miles to Bimlipatam, situated on the south entrance point of a small river. At 3¾ miles from Waltair point and near the coast is Rusi or Sugarloaf, a conspicuous round-topped hill, 490 feet high.

Beacon.—A beacon stands on Rusi or Sugarloaf.

Upada bluffs, 2 miles north-eastward of Sugarloaf hill, have the appearance of flat tablelands about 400 feet high, with a steep face to seaward. Shoal water extends nearly half a mile off-shore in their vicinity.

The high land terminates about 4 miles northward of Sugarloaf hill, whence to Bimlipatam there are isolated conical hills; a large sandhill, 314 feet high, and about 2 miles south-west of Bimlipatam hill, is noticeable.

General charts 829, 70.

Plan of Bimlipatam anchorage on 1424. Var. 0° 30′ E.

BIMLIPATAM is one of the chief ports on the east coast, but the maritime trade has been affected by the completion of the railway between Madras and Calcutta. A hill, 530 feet high, on the north-east slope of which stands the town, is surmounted by a few scraggy trees and a pyramidal obelisk, 16 feet high.

On its eastern slope, about half way up, is a temple, painted white, which shows well when the sun shines on it. This temple is always brightly illuminated every Saturday from sunset to midnight, and the lights may be seen from a long distance. A tall chimney of a gunny factory at Chitávalasa is also a conspicuous object.

LIGHT (*Lat. 17° 53′ N., Long. 83° 27′ E.*).—From a masonry tower, 36 feet in height, situated near the post office, a *white group occulting* light, with a period of system of *one minute*, is exhibited, at an elevation of 35 feet above high water; it shows four eclipses thus:—light, *twenty-six seconds;* eclipse, *four and a half seconds;* light, *five and a quarter seconds;* eclipse, *four and a half seconds;* light, *five and a quarter seconds;* eclipse, *four and a half seconds;* light, *five and a quarter seconds;* eclipse, *four and a half seconds;* it should be visible in clear weather from a distance of 11 miles.

Storm signals are shown at Bimlipatam. *See* pages 74-76.

Anchorage.—In the South-west monsoon anchorage may be obtained in from 6 to 7 fathoms water, with the lighthouse bearing W. ½ S., and in the North-east monsoon anchor in the same depth, with the flagstaff from W. ¾ E. to W. by S. ¾ S., in both positions at nearly one mile off-shore.

The bottom, consisting of mud and sand, is good holding ground, and the anchorage is smoother than at adjacent ports.

Tides and tidal streams.—It is high water, full and change, at Bimlipatam at 8h. 53m.; springs rise 5¼ feet, neaps 3½ feet, and neaps range 1¾ feet. In the roadstead the tidal stream is scarcely perceptible.

Town.—The town, built on the north-eastern slope of the hill on which are the temple and obelisk, is of considerable importance. Northward of the town is a large shallow backwater, the entrance to which, a quarter of a mile north of the town, is used by boats, but is almost dry at low water. The population of the town in 1901 was 10,212.

Communication.—British India Company steamers between Cocanada and Rangoon call weekly, and those between Bombay and Calcutta fortnightly, as also do those of the Asiatic Company. Clan line steamers also call occasionally, taking cargo to England. Bimlipatam has postal and telegraphic communication.

General charts 829, 70.

Plan of Bimlipatam on 1424. Var. 0° 30′ E.

Communication with the shore through the surf in ships' boats is prohibited.

Supplies.—Fresh meat, live stock, and native vegetables in season, are obtainable, and very cheap; fresh water in casks may be procured.

Landing.—The landing place is on the beach between the entrance to the backwater and the port office.

Repairs.—Small repairs can be executed at the East Coast railway workshop.

Hospital.—There is a hospital at Bimlipatam to which Europeans are admitted.

Trade.—The principal exports are gingelly and niger seeds, indigo, myrabolams, hides, horns, and gunny bags; the imports, raw jute, cotton twist, piece goods, machinery, and European stores and liquors. At Chitávalasa, about 2½ miles north-north-westward of Bimlipatam, there is a large gunny bag manufactory, with a conspicuous chimney. Large quantities of salt are also made. Vessels are loaded and discharged by means of surf boats.

Rainfall.—The average annual rainfall at Bimlipatam is 32·6 inches, of which 25·6 inches fall from June to October.

Chart 1424, Bimlipatam to Gopalpur.

COAST.—The coast between Bimlipatam and Konáda, 10 miles north-eastward, is sandy, and broken about midway by some red cliffs 20 to 40 feet high, conspicuous from seaward in the forenoon when the sun shines on them. Between these cliffs and Konáda the beach is fronted by rocks extending a short distance seaward.

Amnam hill, 833 feet high, smooth, flat-topped, and bare, situated about 3¾ miles north-north-east of Bimlipatam lighthouse, is noticeable.

Beacon.—A beacon stands on Kaulvada, a hill, 246 feet high, about 2 miles north-eastward of Amnam.

Konáda (*Lat. 18° 1′ N., Long. 83° 34′ E.*) is situated near the mouth of a small river, the southern side of which rises in bare sandhills to the rising ground extending to Amnam hill; on the low ground on the northern side are several white buildings and some cocoanut trees. Konáda, a town with a population of about 5,000, has a large salt factory, and police and post offices; it has no trade.

Anchorage may be obtained off the river mouth in depths of 5 or 6 fathoms, over sandy bottom.

COAST.—From Konáda the coast trends in a north-easterly direction for 37 miles to Kalingapatam lighthouse, and throughout it is a sandy beach, backed by sandhills from 40 to 60 feet high, broken only by Languliya river mouth, at 25 miles from Konáda. Between Konáda and this river the hills in many places approach the coast; but between the river and Kalingapatam there is an extensive plain, dotted here and there with isolated hills.

Kandívalasa (Santapilli) peak, about 7¼ miles northward of Konáda, is 1,762 feet high, and the loftiest and most prominent peak in this locality, presenting a nearly conical appearance on all bearings from seaward.

SANTAPILLI LIGHT (*Lat. 18° 4′ N., Long. 83° 38′ E.*).—A concrete tower, 73 feet in height, situated half a mile inland at Santapilli, exhibits, at an elevation of 140 feet above high water, a *white group flashing* light, with a period of system of *ten seconds*, showing flash eclipse, *two and a half seconds;* flash eclipse, *seven and a half seconds;* it should be visible in clear weather from a distance of 18 miles.

Santapilli rocks, a patch 4 cables in length in a north and south direction, less than 2 cables in width, and with a least depth of 1¼ fathoms over it, lies 6¼ miles south-eastward of Santapilli lighthouse and 5¼ miles off the land. It has general depths of 9 and 10 fathoms close around, but depths of 6½ fathoms extend a quarter of a mile southward, and of 5 fathoms about 3 cables northward, of the patch. In fine weather the sea does not break on these rocks, nor is there any discoloured appearance over them; but the sea breaks heavily with a moderate swell.

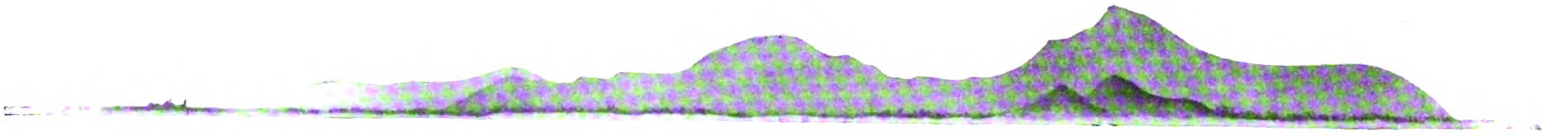
CAUTION.—Santapilli rocks are in the track of coast navigation.

Clearing marks.—Santapilli lighthouse in line with Kandívalasa peak, bearing N. 38° W., leads 1¼ miles south-westward of the rocks (*View on 1424*); and the summit of an isolated, bare, red, double peaked hill, 384 feet high, and 1½ miles north-north-eastward of Santapilli lighthouse, in line with Kandívalasa peak, N. 56° W., leads 2 miles north-eastward of them. The channel inside Santapilli rocks may be taken during daylight. (View on page 254.)

At night pass outside the rocks, and while Santapilli light bears between N.W. ⅝ N. and W. by N. ¾ N. do not shoal the water to less than 20 fathoms.

Beacon.—A beacon, 15 feet high, stands on Ramachandrapur, a flat-topped hill, 538 feet high, situated 5 miles north-eastward of Santapilli lighthouse.

Agra rock is a patch, with a depth of 3¼ fathoms on it at low water, lying 8½ miles east-north-east of Santapilli lighthouse, and one mile off-shore; the sea is not discoloured over this rock, and rarely.


Santapilli lighthouse.
Double peaked hill (384 feet), in line with Kandivalasa peak, N. 56° W.

Clearing mark for Santapilli rocks.

breaks on it. Kandívalasa peak open southward of Ramachandrapur beacon, bearing N. 81° W., leads three-quarters of a mile southward of Agra rock.

Currents.—The currents in this vicinity depend principally on the prevailing wind, and run parallel to the coast. The greatest rate observed between Santapilli rocks and the mainland was one mile.

GANJÁM DISTRICT, commencing at Languliya river, has a coastline of about 100 miles, and the ports of Kalingapatam, Gopalpur, and Ganjám. *See* Chapter I., page 26.

Languliya river (*Lat. 18° 13′ N., Long. 83° 56′ E.*), forming the boundary between the districts of Vizagapatam and Ganjám, flows into the sea at 20 miles north-eastward of Santapilli lighthouse; it is a broad though shallow stream, filled with granite boulders, and navigable only by native vessels of light draught. Upon the left bank of the river, and 5½ miles inland, is the town of Chicacole, once a military station, and the chief station in Ganjám district.

Plan of Kalingapatam on 239.

KALINGAPATAM; the southern port of Ganjám district, situated on the coast and on the southern side of Vamsadhára river entrance, about 13 miles north-eastward of Languliya river mouth, is an open roadstead, protected from the south by a sandy point and some rocks which extend seaward about half a mile, above water near the land but submerged further out. The country in the vicinity is low and flat. The light-obelisk is the southern boundary mark of the port; the northern being the line of the south end of Ampalam village.

LIGHT.—From a stone obelisk, 73 feet in height, painted white, situated on Sandy point, 1½ miles southward of Kalingapatam, a *white occulting* light, with a period of system of *thirty seconds*, is exhibited, at an elevation of 76 feet above high water; it shows light for *twenty-seven and a half seconds*, followed by an eclipse of *two and a half seconds'* duration, and should be visible in clear weather from a distance of 14 miles. The obelisk has a dark blue capital and an outside spiral ladder, painted red.

Sahliundam, 5¾ miles westward of Kalingapatam light-obelisk, is a conspicuous, bare, wedge-shaped hill, 409 feet high and trending eastward. On its eastern slope are two white temples and a tree.

At about 4 miles north-eastward of Sahliundam hill, a low jagged rocky ridge of hills commences.

Satara reef, with 3½ fathoms water, over rock, is situated about 6 cables off-shore, and 8½ cables north-eastward of Kalingapatam light-obelisk. The reef is steep-to on its northern and eastern sides, having a depth of 7 fathoms, over mud, within half a cable, but there

Plan of Kalingapatam on 239.

are two rocky 5-fathom patches south-westward of the reef, and between it and the shoal water, which extends about a quarter of a mile off the coast.

Anchorage (*Lat. 18° 21′ N., Long. 84° 8′ E.*) in the South-west monsoon may be obtained in a depth of 5 fathoms with the port flagstaff bearing N.W. ½ W., and the light-obelisk S.S.W.; and in the North-east monsoon in 4 to 5 fathoms, with the port flagstaff bearing N.W. by W. ¾ W., and the light-obelisk S.S.W.

Storm signals are shown at Kalingapatam. *See* pages 74-76.

Vamsadhára river is not used for navigation, as the entrance is encumbered with sandbanks.

Tides.—It is high water, full and change, at Kalingapatam at 8h. 33m.; springs rise 4¾ feet; neaps rise 3 feet.

Town.—The town, one of the early seats of Mohammedan Government in the Telugu country, shows signs of its ancient importance in the ruins of mosques and other buildings, and, after rain, small gold coins of great age are found on the site of the old city. In 1901 the population was 5,019.

Communication.—Steam vessels of the British India Company between Cocanada and Rangoon call weekly, and those between Bombay and Calcutta fortnightly, at Kalingapatam, and there is telegraph communication with all parts.

Supplies.—Fresh provisions can be obtained, but only in small quantity; they may, however, be procured from Chicacole, 14 miles distant, but two days' notice must be given. Fresh water here cannot be recommended.

Trade.—The exports are chiefly grain, pulse, myrabolams, and turmeric; and imports, haberdashery, glassware, and gunny bags.

Chart 1424.

COAST.—Between Kalingapatam and Bávanapádu, the coast is straight and sandy, backed for the first 10 miles by numerous isolated hills, which rise gradually in height as their distance from the coast increases. The country round Bávanapádu is low and flat.

Bávanapádu is 19 miles north-eastward of Kalingapatam, and about a mile southward of the village a slight bend in the general direction of the coast forms a small point, off which rocks, 12 feet high, extend about one cable; a small river, the entrance to which is shallow and entirely closed at low water, runs into the sea about half a mile northward of the rocks.

Beacon.—On the beach at Bávanapádu there is a high circular beacon, painted black and white in horizontal stripes.

Plan of Pundi river entrance on 1424.

Pundi.—At about 8 miles north-eastward of Bávanapádu is a rounded rocky point; Pundi is situated a mile further

General charts 829, 70.

Plan of Pundi river entrance on 1424. Var. 0° 40′ E.

northward, within the mouth of a small river. The town is not visible from the sea, but a high white obelisk, with its summit 60 feet above the sea, and a flagstaff, close together on the north side of the river, indicate its position; Bendi hills, a flat range, 576 feet high, lie 3 miles north-westward of Pundi. Khirsinga, a small red hill, 169 feet high, is on the coast about 1½ miles north-eastward of the obelisk.

Anchorage (*Lat. 18° 41′ N., Long. 84° 28′ E.*).—The anchorage off Pundi is in 7 to 8 fathoms water, over sand, with the obelisk bearing about W. ⅞ N., and three-quarters of a mile off-shore. The river has about 3 feet water on the bar at low water springs, and in very fine weather native vessels up to 70 tons enter and anchor off the village.

Tides.—It is high water, full and change, at Pundi river entrance, at 9h. 5m.; springs rise 6½ feet, neaps rise 4½ feet, neaps range 2 feet.

Village.—The village of Pundi is small, and having no trade is of little importance. Ships' boats can enter the river with safety at high water, when the swell is moderate.

Communication.—There is a post office in the village; a good road connects Pundi with the trunk road near Bendi hills, 3 miles inland.

Supplies can only be obtained in very small quantities, but fish is abundant and cheap.

Chart 1424, Bimlipatam to Gopalpur.

COAST.—Between Pundi and Baruva, nearly 15 miles north-eastward, the coast is sandy, and, except near Baruva, rises gradually, and is fairly well wooded.

Rati beacon, 8 miles north-eastward of Pundi, is an obelisk, 14 feet high, situated half a mile inland on a double-peaked hill, 342 feet high, at the end of a small range of about the same height running down to the coast. This range is very prominent from the north-eastward or south-westward, and at a distance of 4 or 5 miles has the appearance of a headland.

Mahendragiri range, precipitous, and about 5,000 feet in height, is about 14 miles north-westward of Baruva.

Rock.—A rocky patch, with 6½ fathoms on it, and 9 to 10 fathoms around, lies 2¾ miles east-north-east of Rati beacon, and nearly 1¼ miles off-shore.

Plan of Baruva anchorage on 1424.

BARUVA, a town of some importance, is situated on the left bank of a small river; the Custom-house and a few native houses being the only parts visible from seaward, but a grove of casuarina trees to

Plan of Baruva anchorage on 1424. Var. 0° 30′ E.

the south-westward of the former is conspicuous, and the flagstaff and two high beacons mark its position. The surrounding country is level, and the coast fringed with cocoanut trees.

Lights (*Lat. 18° 53′ N., Long. 84° 36′ E.*).—On the yardarms of the port flagstaff, at an elevation of 46 feet above high water, two *white fixed* occasional lights are exhibited from lanterns, and should be seen from a distance of 3 miles in clear weather.

Beacons.—Two beacons, 50 feet high, about 65 feet above high water, and 70 yards apart, in a N. by E. and opposite direction, are situated about 2 cables north-eastward of the flagstaff; the southern beacon is painted white and the northern black and white in horizontal bands.

Anchorage.—The best anchorage is in 4½ fathoms water, over sand and mud bottom, with the flagstaff bearing between N.W. and N.W. by W.

Tides.—It is high water, full and change, at 9h. 5m. (approximate); springs rise 6½ feet, neaps 4½ feet, and neaps range 2 feet. There is no perceptible tidal stream in the roadstead.

Town.—The town has very little trade, but a number of native passengers embark and disembark during the fair season; in 1901 the population was 4,161.

Communication.—The steamers of the British India S.N. Company call weekly, and there is a post and telegraph office at Baruva. A road connects the town with the trunk road about 2½ miles inland.

Supplies.—Fresh provisions can be obtained in abundance, also good water.

Landing.—The natives assert that landing can always be affected except in the heaviest weather, and that often when it is unsafe to land at Gopalpur there is no danger at Baruva. Masula boats are always available, and flag B of the International code is the signal for a boat.

Chart 1424, Bimlipatam to Gopalpur.

COAST.—Between Baruva and Gopalpur, about 30 miles to the north-eastward, the coast is nearly straight, and sandy. About 5 miles northward of Baruva and 3 miles inland, there is a small range of bare hills, which are nearly 600 feet in height. Near Kowita, 10 miles north-eastward of Baruva, the land rises gradually from the coast to a height of about 300 feet, forming a wooded tableland, which is connected with lower ranges of hills farther back.

The higher ranges are so frequently obscured as to be of little use to the mariner. Other prominent hills are: Ichápur, 4½ miles northward of Kowita, a sharp cone, 514 feet high, surrounded by some

General charts 829, 70.

Chart 1424, Bimlipatam to Gopalpur.

smaller hills, which rise nearly 400 feet; and Dandrási, 676 feet high, 5¾ miles north-eastward of Ichápur, which from the eastward is a round-topped hill, but from the southward has a long double summit, the western being slightly the higher.

Beacon.—Kowita beacon, at an elevation of 279 feet, is situated on Kowita tableland about 2¼ miles inland, and about 1½ miles south-west of it is a high tree.

Raegara (*Lat. 19° 17′ N., Long. 84° 39′ E.*), a conspicuous range with four peaks, the highest being 2,914 feet above high water, is situated 15 miles westward of Gopalpur.

Investigator rock, with a depth of 1¼ fathoms over it, lies three-quarters of a mile off-shore about 4 miles south-south-east of Kowita beacon; the water is not discoloured over the rock, nor does it show by a break.

Sonapur, a small port, 18 miles north-eastward of Baruva, is situated at the mouth of a small river; it has a small Custom-house with a flagstaff, painted black, standing on the beach.

Beacons.—An obelisk and a column, painted white, each about 50 feet high, and 20 feet apart, stand on an islet within the mouth of the river.

Currents and winds.—The currents off the coast between Bimlipatam and Gopalpur are mainly influenced by the wind, the tidal stream even at springs having very little effect. In December and January, when north-easterly winds prevail, the current at a mile from the coast sets steadily south-westward, parallel to the coast, at a rate of one-half to three-quarters of a knot an hour.

Towards the end of February the wind hauls round to the south-west, and in March blows steadily from that quarter, generally falling light in the morning, and freshening during the afternoon to a force of from 5 to 6. The current then sets north-eastward parallel to the coast, its rate close in-shore being about half a knot, but at 10 miles and upwards from the coast its rate is frequently from 2 to 3 knots.

Plan of Gopalpur on 1425.

GOPALPUR, about 11 miles north-eastward of Sonapur, and the principal port in Ganjám district, stands on rising ground, and its white houses may be seen from a distance of 12 miles seaward; it is an open roadstead with no shelter, but landing and shipping operations are possible throughout the year, except occasionally when the surf is too high. Loading and discharging is effected by surf boats.

In the town the most prominent building is that of the British India Steam Navigation Company, on which the word *Gopalpore* is

General charts 829, 70.

painted in large letters. The limits of the port are defined by white pillars. The port flagstaff, painted white, about 60 yards in-shore, is the only one on this coast having a topgallant mast.

Boats cannot enter the small stream which flows into the sea immediately northward of the town.

The population of Gopalpur was 2,150 in 1901.

LIGHT.—A *white fixed* light is exhibited, at an elevation of 54 feet above high water, from the port flagstaff, 33 feet in height and painted white, situated about 60 yards from the low-water mark, and should be visible in clear weather from a distance of 10 miles.

Pier.—An iron screw pier, extending 960 feet seaward from abreast the port flagstaff, but not outside the line of surf, is little used, and rapidly deteriorating; it is not proposed to repair it.

The pier can sometimes, in the calms of January and February, be used by surf boats; at other times the outer line of breakers is close to its end. Landing is frequently impracticable in June and July.

Light (*Lat. 19° 15′ N., Long. 84° 55′ E.*).—A *red fixed* light is shown from the end of the pier, at an elevation of 25 feet above high water, and should be visible in clear weather from a distance of about 3 miles.

Storm signals are shown at Gopalpur. *See* pages 74-76.

Anchorage.—Anchorage may be obtained, in about 8 fathoms water, over sand and mud bottom, with the pier end bearing N.W. by W., and the North port pillar N. ¼ W., or about a quarter of a mile south-westward of that position in about 7½ fathoms.

Vessels working cargo usually anchor in line with the pier; there is a patch of hard ground 4 cables eastward of the pier, which should be avoided. In the windy months, April to July, anchor in 9 fathoms, with a good scope of cable.

Ballast must be discharged outside the 12-fathoms contour line.

Tides.—It is high water, full and change, at Gopalpur at 9h. 40m.; springs rise 6½ feet, neaps 4¼ feet, neaps range about one foot.

The soundings on the plan of Gopalpur are reduced to the March tides; there is a foot more water in November, as the mean level of the sea is one foot higher in November than in March.

Town.—The small town, which stretches back for about half a mile from the pier, had a population of 2,150 in 1901.

Communication.—The British India Company's steamers run weekly to Madras and Colombo, calling at coast ports, and fortnightly to Calcutta and Bombay; also to Rangoon direct, carrying large numbers of emigrant coolies. There is a station of the East Coast

Plan of Gopalpur on 1425. Var. 0° 30′ E.

railway at Berhampur, about 7 miles inland. A canal and a post and telegraph office in the town connects Gopalpur and Ganjám, thence by Chilka lake to Purí.

Supplies.—Only small quantities can be obtained of fresh meat, bread, and vegetables; the water, from wells, is insufficient for shipping.

Hospital (*Lat. 19° 20′ N., Long. 84° 45′ E.*).—There is no hospital accommodation for seamen nearer than Berhampur, but emergency cases will always be admitted into the Local Fund dispensary.

Quarantine.—A vessel with cholera, smallpox or other epidemic disease on board, must inform the boarding officer at the earliest opportunity. There are special rules relating to quarantine at Gopalpur, copies of which are supplied by the boarding officer.

Trade.—The principal exports are grain, pulse, hides, skins, sal timber, hemp, coir manufactures, oilseeds, myrabolams, and dried fish; and imports, sugar, piece goods, apparel, jute manufactures, liquors, matches, kerosene oil, cotton twist, and metals.

Winds, weather, and climate.—The following table is formed from observations taken for several years at Gopalpur:—

Month.	Wind.		Force.	Weather.	Rainfall.	Temperature (average).	Remarks.
	Day.	Night.					
					Ins.	°	
January	N.E. to S.E.	N.N.W.	2	Clear and fine.	Nil.	74	Sea very smooth.
February	S.S.E.	Calm.	2	Do.	1	79	Occasionally strong southerly wind.
March	S.S.W. to South.	S.S.W. to South.	4 to 5	Do.	Nil.	82	Less wind at night.
April	S.S.W.	S.S.W.	5	Fine.	Nil.	83	Do. do.
May	S. by W.	S. by W.	4	Do.	Nil.	87	Very hot; occasionally N.W. wind; heavy surf.
June	S.S.E. to South	S.S.W.	5	Cloudy.	2	87	Rainfall varies.
July	S. by W.	S. by W.	4	Cloudy and wet	7	85	Occasional N.W. wind; heavy surf.
August	S.S.W.	S.S.W.	3	Do.	10	83	Do. do.
September	Chiefly South	Variable	2	Fine but wet.	8	86	Hot and oppressive.
October	E.S.E.	N. by W.	2	Variable, wet.	11	85	Rainfall varies greatly.
November	East	N. by W.	3	Do.	6	79	Do. do.
December	N.E. to S.E.	N.N.W.	2	Fine and cool.	2	74	Sea smooth.

General charts 829, 70.

Plan of Gopalpur on 1425. Var. 0° 30′ E.

The South-west monsoon breaks about 15th June. Winds constantly blow along shore near Gopalpur in March and April; these winds farther north are occasional only, and the first intimation of them is the absence of any lull in the sea breeze at night; they cause an unpleasant sea for boats, and after blowing about three days subside quickly.

Strong winds are frequent off the land between Gopalpur and Palur bluff, but cyclones do not appear to pass over Gopalpur hills.

Currents.—The currents usually set with the prevailing wind. About the middle of January the north-easterly current begins, and by the middle of February it sets steadily east-north-east, running half a knot an hour close in-shore, and increasing up to 1½ knots at 12 miles off the coast. At the latter distance its direction is about north-east by east, or inclined towards the land, which should be guarded against.

The north-easterly current continues to run until July, when the south-westerly current begins, and gradually strengthens; it sometimes runs over 2 knots an hour. Between March and August, owing to the displacement of sand along this coast, all the river mouths have narrow spits trending north-eastward from their entrances.

Chart 1425, Gopalpur to False point. Var. 0° 40′ E.

Berhampore, 8 miles by road in a west-north-west direction from Gopalpur, had a population of 25,729 in 1901, and is a station on the East Coast railway.

Hills.—Mansurkota hill, rocky, isolated, and 165 feet high, is situated 2¼ miles northward of Gopalpur, and shows over the sand-hills.

Two remarkable isolated hills are situated about 8 miles northward of Gopalpur; Londabans, the eastern hill, is 570 feet high, and presents a conical sugarloaf shape from every direction.

Rushikulya river, about 115 miles long, is utilised for irrigation purposes by a series of works, but neither it nor the canals are used for navigation.

GANJÁM (*Lat. 19° 22′ N., Long. 85° 4′ E.*), at the mouth of Rushikulya river, 12 miles north-eastward of Gopalpur (there are several small fishing villages between), was formerly the capital of the district; it stands with the remains of an old fort on rising ground, but to the north the country is low and malarious.

There is a flagstaff with some white buildings near it, and the cemetery wall and north boundary pillar are generally visible in the morning; 2½ miles north-eastward of the cemetery are three remarkable clumps of casuarinas, which are perhaps the best guide to the place.

Owing to the heavy surf outside, and shifting banks, it is never likely to be used as a port, and its chief land trade consists in the export of rice to Orissa; the collector of the district resides at Chatrapur, about 5 miles westward of old Ganjám, and the bungalow is conspicuous from seaward.

Anchorage.—The best anchorage, in a depth of 4½ fathoms, is with the flagstaff bearing West; the holding ground is very good.

Town.—The town had a population of 4,397 in 1901, but most of the once handsome buildings are in ruins, and very little of it is visible from seaward.

Communication.—Ganjám is a station on the East Coast railway.

COAST.—Palur bluff (*Lat. 19° 27′ N., Long. 85° 8′ E.*), about 6 miles north-eastward of Ganjám, is 580 feet high, backed by Kujidaba peak, a saddle-shaped mountain 1,114 feet in height, and forms a bold north-eastern termination on the coast to the high ranges of Ganjám district. The bluff is about a mile southward of the southern end of Chilka lake, which is the southern part of Mahanadi river delta.

A low beach of sandhills, backed by a little cultivation and grazing ground, stretches 33 miles north-eastward from Palur bluff to Chilka mouth, the entrance to Chilka lake. On this low coast there are few marks which can be identified from seaward; the most conspicuous is Mita kua bungalow, a small white stone building, on a sandhill close to the sea and 20 miles from Palur.

Beacon.—A beacon stands close to the sea, 13 miles north-eastward of Palur.

Chandiko mountain, 1,517 feet high, 16 miles northward of Palur and on the western shore of Chilka lake, stands out somewhat from the high ranges behind the lake, and from the southward shows as a double peak.

Danai, a prominent sharp peak, is 1,892 feet high, and 21½ miles north-north-west of Mita kua.

PURI DISTRICT.—Boundary.—The boundary between Madras Presidency and Bengal Province is at the south-west end of Chilka lake, and is also the western extreme of Puri District, which has a coastline of about 65 miles, and includes Puri port. *See* Chapter I., page 30.

CHILKA LAKE, a pear-shaped expanse of water, about 37 miles in length, 13 miles in greatest breadth at its northern end, and barely averaging 4 miles at its southern part, is separated from the sea by a long sandy ridge, in places a little more than a cable wide; its average depth is from 3 to 5 feet, and in no part is it much more than 6 feet.

The tidal stream, which rushes through the opening connecting it with the sea, keeps the water brackish during the dry season, from December to June, but when the Bhargavi and Daya rivers, which flow into it, come down in flood the salt water is driven out, and it becomes a fresh-water lake.

On the west and south it is walled in by lofty hills, but to the north it disappears in endless shallows, sedgy banks, and islands just above the surface. Nulbunno island, a reed forest, about 5 miles in circumference, occupies its centre, and on the eastern side are several islands; water fowl of all kinds are very abundant in every part.

The lake is connected with Rushikulya river by a tidal canal 7 miles long, which is navigable throughout the year by flat-bottomed vessels; large quantities of grain and salt are exported in this manner. Difficulty is said to exist in maintaining an outlet from the lake to the sea.

Rambha (*Lat. 19° 31′ N., Long. 85° 7′ E.*), an important village at the south-west end of Chilka lake, has an extensive trade with Orissa, from which large quantities of rice are imported, by means of peculiar boats built of flat planks, and with Rangoon, to which prawns are exported. In 1901 the population was 4,028. A steam launch plies between Rambha and the north-east end of the lake, but the canal to Ganjám and Gopalpur is lessening the trade of Rambha.

Chilka mouth, the entrance to Chilka lake, is small, not easily seen, and has about 3 feet water on the bar in the dry season; and probably more during the rains, but the surf is then so high that the entrance is not used, cargo being taken either to Gopalpur or Purí. At the entrance, shallow water and breakers extend about 4 cables off-shore, there being depths of 6 to 8 fathoms close outside them; during a period of 50 years from 1840 the entrance moved 3 miles east-north-eastward.

Babeswal temple, about 6 miles west-south-west of Chilka entrance, is sometimes visible amongst the trees; it is black, and similar in shape to Purí temple, but is very small.

Tides.—It is high water, full and change, at Chilka lake entrance at 9h. 10m.; springs rise 4½ feet, neaps 3 feet, neaps range 1½ feet.

Harchandi temple, three-quarters of a mile inland and 4 miles east-north-east of Chilka mouth, stands on a sandhill, and resembles Purí temple, but is much smaller.

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Chart 1425, Gopalpur to False point.

Depths off-shore.—Between Gopalpur and Purí the coast is free from outlying dangers; the 10-fathoms contour line is generally from one mile to 2½ miles from the coast, but it extends to 4 miles off for a distance of about 6 miles eastward of Mita kua bungalow; and there are several 10-fathoms patches within 6 miles south-eastward of Purí; the 100-fathoms contour line is 24 miles off Gopalpur and about 15 miles off Purí. The bottom near the coast is sand, between depths of 10 and 23 fathoms it is sand and mud, and over 23 fathoms usually mud.

Plan of Purí on 1425.

PURÍ, locally known as Jagannáth (Juggurnaut), is one of the most sacred places of the province, which for 2,000 years has been the holy land of the Hindus, and is situated on the coast and on a low sandy ridge 8½ miles east-north-east of Harchandi temple.

The famous Jagannáth pagodas are at the back of the town, 7 cables from the sea, on low land covered with small trees, and consist of three circular towers, decreasing in size eastward, each crowned by a white dome. The western pagoda is 192 feet in height; the three pagodas are in line when bearing N. 85° W., and are seen separately on a northerly bearing; they are conspicuous in the forenoon from seaward. The western side of the pagodas appears perpendicular, while the eastern side slopes.

The port boundary pillars are painted black and white in horizontal stripes.

LIGHT.—From a pedestal surmounting a house, the whole 33 feet in height, painted white, and situated on the parapet wall of the Circuit house, which has *Pooree* painted in white letters on it, a *white occulting* light, with a period of system of *fifteen seconds*, is exhibited, at an elevation of 44 feet above high water; it is eclipsed for *five seconds*, and should, in clear weather, be visible from a distance of 11 miles.

Position (*Lat. 19° 47′ 42″ N., Long. 85° 49′ 38″ E.*).—The flagstaff, painted white, on the coast and close to the port office, is in the position given.

Storm signals are shown at Purí port office flagstaff. *See* pages 74-76.

Anchorage.—In fine weather anchorage may be taken up off the town in from 7 to 8 fathoms water, over good holding ground; the best berth is said to be in a depth of 7 fathoms with the lighthouse bearing N. ½ E. and the south-west port pillar N.W. ½ N. The bottom is nearly all clay, and the depths decrease gradually from

Plan of Purí on 1425. Var. 0° 40′ E.

20 fathoms to 7 fathoms, and then rapidly to the beach, so that the lead should be constantly used.

An old ballast ground in 10 fathoms, 2½ miles S.E. by E. ⅓ E. from the flagstaff, should be avoided.

Tides.—It is high water, full and change, at Purí at 9h. 15m.; springs rise 4½ feet.

The mean level of the sea is one foot higher in November than in March; the soundings on the plan of Purí are reduced to the March tides.

Town (*Lat. 19° 48′ N., Long. 85° 50′ E.*).—The sea front of Purí is about a mile long, and the Government offices, whitewashed and conspicuous, stand on the beach, with a sandy ridge between them and the town; the site is salubrious, as the monsoon blows on it fresh and cool from the sea, but during the rains it is not so healthy.

Purí, being the seat of the shrine of Jagannáth, and a great resort of pilgrims, is a city of lodging houses, and, excepting the principal avenue which leads from the temple to the country house of Jagannáth, has mean and narrow streets, the houses being built of wattle covered with clay, and raised on mud platforms about 4 feet high. The population was 49,334 in 1901, but that number is greatly increased by pilgrims at certain times.

The diseases which arise from overcrowding of the pilgrims are aggravated by the faulty drainage, and a complete scheme is in contemplation; other methods have also recently been taken to improve the sanitary conditions.

Communication.—Steamers of the British India S.N. Company call occasionally, and a branch railway runs to Kurda road, where it connects with the East Coast railway. There is a post and telegraph office in the town.

Supplies are scarce and very expensive, but sheep, fowls, eggs, rice, flour, sugar, and vegetables, can generally be obtained. Fresh water may be procured, but it is not recommended.

Landing.—The usual landing is at the flagstaff; ships' boats cannot land at Purí in the finest weather, but masula boats can be obtained.

Vessels load and discharge by surf boats.

Hospital.—Seamen are received, if absolutely necessary, at the municipal dispensary hospital.

Trade.—The only export is rice, of which a quantity is exported annually to Ceylon and Cochin; the imports are Government's stores, treasure for the temples, and gunny bags from Calcutta.

General charts 829, 70.

Plan of Purí on 1425. Var. 0° 40′ E.

Weather.—Cyclonic storms occur late in April, in May and June, but rarely in July; they also occur in October and November. The swell on the beach generally gives good warning of the approach of a cyclonic storm.

The fine weather season is from the middle of November to the middle of March, when the sea breeze sets in about noon and blows moderately until 9h. p.m.; the land wind then follows until daylight, after which the wind is variable till noon.

After the middle of February the sea breeze sometimes lasts all night, and blows freshly for 3 days, causing a sea which makes boat work inconvenient. The rainy season is from May to November; and August is the wettest month, with an average rainfall of about 14½ inches, the annual fall being nearly 40 inches.

Chart 1425, Gopalpur to False point.

COAST.—From Purí the coast trends in an east-north-east direction for 23 miles to Tundaha, and thence more northerly for 11 miles to Devi point, northward of which is Devi river mouth, one of the branches of the Mahanadi. The coast is sandy, with bare sandhills 20 to 70 feet high, and groups of trees inside them. It is so low that it must not be approached at night or in hazy weather, but it being free from off-lying dangers, it may be safely navigated by using the lead, and not shoaling the water to less than 12 fathoms; bearing in mind that there are depths of 8 fathoms close outside the breakers.

CAUTION.—Reliance cannot be placed on estimating the distance of the coast by the eye, as owing to the fine sand haze the land is often much nearer than it appears to be. At night the sandy beach blends with the water, and the tops of large trees, showing over the hillocks, appear very distant on an indefinite horizon. This is especially the case on moonlight nights, when vessels are tempted to keep near the land in order not to be taken past their ports by the currents. In the South-west monsoon a heavy surf breaks on the coast, and should a vessel touch the bottom she is almost certain to be lost.

Baleswur temple (*Lat. 19° 50′ N., Long. 85° 57′ E.*), 7 miles eastward of Purí and half a mile inland, is a small black pagoda-shaped building with trees round it; only its upper portion is visible from seaward.

Kusbhadra river.—At 14 miles from Purí is Kusbhadra river entrance, which is a very shallow stream; there are breakers, but there is no shoal at its entrance. Ramchaudi, a small temple with two palms, is on the land about a quarter of a mile northward of the river entrance.

General charts 829, 70.

Chart 1425, Gopalpur to False point. Var. 0° 50′ E.

Black pagoda (Kanárak), situated 3 miles north-eastward of Kusbhadra river entrance and 1¾ miles inland, although in a ruinous state is most prominent, being about 130 feet high, standing on low land with a few trees at its base and presenting the appearance of the gable end of a house with a roof sloping westward; from the north-eastward it shows as a black pyramid, and is one of the most exquisite memorials of sun worship in India.

Tundaha obelisk, 15 feet high, is situated on the sandhill within the beach at 9½ miles eastward of Kusbhadra river entrance.

CUTTACK DISTRICT, commencing at the Prachi river has a coastline of about 70 miles; Devi and Mahanadi rivers and False point anchorage are on this stretch of coast. *See* Chapter I., page 31.

Prachi river mouth is situated one mile eastward of Tundaha obelisk; the stream is shallow.

Nulyasai, a conspicuous fishing village on the sandhills, lies on the coast at about 6 miles north-eastward of Tundaha obelisk.

Plan of Devi river on 756.

DEVI RIVER (*Lat. 19° 59′ N., Long. 86° 25′ E.*), one of the largest branches of the Mahanadi and formed by the junction of the Great and Little Devi, flows through a low level district, and reaches the sea after passing westward of a long narrow sand spit, which terminates in Devi point. The country within the river entrance is a dense swampy jungle, with no inhabitants.

The locality is indicated by Nulyasai village, and Balijori obelisk, 15 feet high, a trigonometrical station on the sandhills, 2½ miles northward of Devi point; on closing the river the breakers on the bar may be seen, and, from a sufficient height, the river itself over the sand spit.

Central sand.—The outer bank, from about 1¼ miles eastward of Devi point, trends northward and north-westward to Central sand on the northern side of the entrance; it does not always break in fine weather, and its edge is more than a mile from the line of coast, so that care must be observed in the approach. Balijori obelisk, bearing westward of N.N.W., leads eastward of the bank; and in passing, the water must not be shoaled to less than 9 fathoms.

Entrance.—Depth.—In 1889 there was a passage into the river, 3½ cables in length, and with a depth of 8 feet at low water, through a gap in the breakers about one cable wide. The entrance of the passage was then about 1$\frac{1}{10}$ miles E. by N. from Devi point, and the direction of the passage was N.W.

General charts 829, 70.

Plan of Devi river on 756. Var. 0° 50′ E.

From within the breakers on the port hand, a W.S.W. course led into the river with depths of 14 to 30 feet. In the South-west monsoon the entrance probably breaks right across.

Landing.—In case of necessity, there is a landing for boats, with southerly winds only, in the bight northward of Central sand, at about $1\frac{3}{10}$ miles northward of Devi point.

Outer anchorage.—There is anchorage with westerly winds off Devi river in 8½ fathoms, sand and mud, with Balijori obelisk bearing N. by W. ⅝ W., and the centre of the gap in the breakers W. ⅝ N.; or with on-shore winds, in 8 fathoms, with the obelisk N.W. ⅛ N., distant $1\frac{6}{10}$ miles.

Inner anchorage.—There is good anchorage inside in 3 fathoms, with Devi point bearing N.E. by E., distant about 6 cables. Small steamers, drawing 8 to 10 feet, might enter the river; at present there is little trade, light winds making the entrance difficult for sailing vessels in the fine weather season.

Tides.—It is high water full and change, inside Devi river mouth at 8h. 54m.; springs rise 9 feet, neaps 6½ feet, and neaps range 2 feet.

Chart 1425, Gopalpur to False point.

COAST.—From Devi point the coast curves 17 miles north-eastward to Jotdar river entrance, and consists of low sandy beach with hillocks 15 to 20 feet in height. At two places the coast is so low that it is probable the sea in heavy weather washes over it into the backwater behind.

Hurrichpur river (*Lat. 20° 2′ N., Long. 86° 26′ E.*).—The shallow mouth of the Hurrichpur branch of Devi river is 4 miles north-eastward of Devi point, and about 1½ miles up the Hurrichpur is the small post town of that name. The entrance to this stream is not visible from seaward.

Magarkhia Tanda beacon is situated 10½ miles north-eastward of Devi point.

Jotdar river.—The Jotdar mouth is shallow, and there are always breakers across it; in 1889 its position was marked by a ridge of high sandhills.

Coast.—From Jotdar river the coast trends north-eastward for 13 miles to Mahanadi point, which is nearly 2 miles eastward of False point lighthouse, and thence the eastern coast of Dowdeswell island bends northward. Patakund river is very shallow; its entrance is nearly 6 miles from Jotdar entrance, and north-eastward of Patakund river the land is low. Senkud obelisk, 15 feet high, is situated on the west side of Patakund river entrance.

General charts 829, 70.

Chart 1425, Gopalpur to False point.

Depths off-shore.—Between Purí and Mahanadi, the 10-fathoms contour line is 4 miles off-shore seaward of Black pagoda, 1½ miles near Devi river, and 6½ miles south-eastward of Senkud obelisk, closing the shore to 3½ miles eastward of Mahanadi point. The 100-fathoms contour line averages 16 miles off-shore until, eastward of Devi river, it bends away from the land. The bottom under 10-fathoms is sand; from 10 to 30 fathoms, dark mud; and over 30 fathoms, soft grey mud.

Plan, Mahanadi river entrance on 756; False point anchorage, 755.

MAHANADI RIVER.—Entrances.—The south entrance to which is about 4½ miles north-eastward of Senkud obelisk, has a course of about 510 miles, and receives many tributaries. The land at the entrance of the Mahanadi, and near False point lighthouse, is low, intersected by numerous creeks, and the sea face forms long narrow islands, joined by shoal ground, which are constantly altering.

It had, in 1889, a long line of heavy surf extending right across and one mile seaward of it; and the north entrance, 1½ miles eastward of False point lighthouse, also had heavy breakers extending across it. The rivers of the delta are subject to frequent changes.

Depths.—Inside Mahanadi river entrance, the navigable channel appears to be about 2 cables in breadth, with depths of 12 to 30 feet.

Cuttack city (*Lat. 20° 29′ N., Long. 85° 54′ E.*), the headquarters of the Cuttack district and of the Orissa division, is situated on the peninsula formed by the bifurcation of Mahanadi river, where the Katjuri river leaves it; it became an important place in the tenth century, and the ancient fort, of Hindu origin, is one of its most conspicuous monuments.

In addition to the usual public offices, the chief public works are the stone embankments by which the city is protected from inundations; it has also several important educational institutions, and is noted for its filigree work. In 1901 the population was 51,364.

Communication.—River steamers with cargo boats in tow connect the port with the coasting steamers at False point, a distance of 75 miles viâ Iumboo and the Iumboo and Kendrapara extension canal. Cuttack has railway communication.

Hospital.—The general hospital has beds for 60 male patients.

Plan 755, False point anchorage.

FALSE POINT LIGHT.—Within the north entrance to Mahanadi river, and 1½ miles westward of Mahanadi point, a stone lighthouse, 132 feet in height, painted reddish-brown, with a large white ten-pointed star on its south-eastern side, exhibits at an eleva-

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tion of 127 feet above high water, a *white occulting* light with a period of system of *thirty seconds*, which shows light for *twenty-six seconds*, followed by an eclipse of *four seconds* duration, and should be visible, in clear weather from a distance of 17 miles.

In January, February, and March, the light is occasionally obscured by fog on the land, which sometimes causes it to show a deep red colour; during these months, when approaching False point, the lead should be consistently used, and the water not shoaled to less than 11 fathoms, which depth is about 3 miles from the shore. A good guide is to examine the bottom, and if it is sand mixed with mud, the vessel's head should be kept seaward till daylight.

Signal station.—Communication can be made with False point lighthouse by the International code of signals, and messages are forwarded and received by telegraph.

NOTE.—In the North-east monsoon, or with north-east winds, False point should be avoided by sailing vessels, it being then a lee shore with generally a westerly current in the vicinity.

FALSE POINT ANCHORAGE.—A tongue of land extends north-eastward from False point lighthouse for a distance of 3 miles, nearly meeting Turtle point, the south extreme of Dowdeswell island (Nurrea banga Nassi) which island, with a spit at its north end that dries, stretches about 4¼ miles northward, and is sometimes joined to the mainland. The coast is a range of small sand hillocks, averaging in height from 6 to 8 feet above high water, and covered with grass and scrub.

The anchorage northward of Dowdeswell island and in the bay westward of its northern part is known as False point anchorage, which is safe, roomy, and landlocked by islands and sandbanks, and has two navigable buoyed channels.

Reddie point.—The end of the spit, which dries at half ebb, extended about one cable northward and 9 cables westward of the north extreme of Dowdeswell island in 1909, but it is continually changing; the western end of this spit is known as Reddie point.

Huki Tala (*Lat. 20° 25′ N., Long. 86° 47′ E.*), on the western side of Dowdeswell island is the harbour-master's station, but some of this part of the island was washed away, and from the latest information only the refuge house, a large stone building with a flagstaff, and a few cocoanut palms were standing; the house is easily distinguished from seaward.

Signal staff.—The signal station of the coast telegraph is about a cable westward of the refuge house at Huki Tala; vessels can communicate by the International code. The staff is 73 feet in height, and consists of a lower mast and topmast, with a yard, all painted white.

Storm signals are shown from the signal staff at Huki Tala. *See* pages 74-76.

Western shore.—The inner shore of the bay, westward of Dowdeswell island, embracing Plowden island, Jambu river entrance, and towards Temple point, is principally mangrove swamp. Temple point is a projecting point of trees, 1½ miles north of the Jambu river entrance, and 3⅓ miles westward of Huki Tala.

From Temple point to South Broni river, 3⅓ miles northward, the land is low, covered with grass and scrub, with occasional patches of mangrove swamp, fringed with sand, which forms the high water line. Further northward, the sandhills are more elevated, and the mouth of Broni Mohan creek forms a conspicuous gap between high sandhills.

Channels.—Two channels, which have an entrance common to both, immediately northward of Reddie point and a bar westward of it, lead inland: Bakud creek, the southern channel, is a short, deep branch of Mahanadi river; Jambu river, the northern channel, leads to Jambu settlement or location. Tidal creeks, navigable by country boats throughout the year, connect False point with Dhamra and Brahmaní rivers to the northward, and with Devi river to the southward.

Depths.—There are depths of from 12 to 17 feet in the entrance channel northward of Dowdeswell island shoaling to the bar on which the depths are from one foot to 5 feet, and at high water cargo boats and small steamers enter without difficulty. In Bakud creek the depths are from one foot to 5 feet, and in Jambu river from 6 to 20 feet in mid-channel; the latter is available for vessels of 10 feet draught at high water.

Beacons and marks.—Reddie point and the spit extending northward of Dowdeswell island are continually changing; the beacons marking the point and spit are shifted as the changes occur. The positions given below are from the latest information, but no reliance should be placed on them.

Reddie beacon (*Lat. 20° 26′ N., Long. 86° 48′ E.*), 50 feet in height, painted black, with an oblong basket as a topmark, is situated about 8⅓ cables south-eastward of Reddie point, and N. ⅝ E. 1½ miles from Huki Tala signal staff.

Prince Arthur beacon, consisting of a pole and cage, painted white, is on Prince Arthur point, on the western side of Dowdeswell island, about one mile southward of the refuge house.

Plan 755, False point anchorage. Var. 0° 50′ E.

A beacon stands at nearly 2 cables south-eastward of Plowden point.

A beacon, painted white, is situated on Black point, the north-east end of an islet on the southern side of the entrance to Jambu river.

There is a remarkable tree known as Temple tree, the highest in the vicinity, with a pole and black basket projecting from its summit, at nearly one mile west-north-west of Temple point.

On the northern entrance point of South Broni river is an upright spar with topmast and black cage.

Buoys.—Fairway buoy, painted black and white in horizontal stripes with staff, lies in 27 feet water, about one mile northward of the north point of Dowdeswell island.

On the southern side of the entrance channel are:—

Outer spit buoy, painted black and surmounted by a staff and cage, moored in about 17 feet water, 4 cables north-westward of the north point of Dowdeswell island.

Inner spit buoy, conical and painted black, moored nearly 8 cables west-north-west of the north point of Dowdeswell island.

Flat buoy, conical and painted black, about 5 cables westward of the preceding buoy.

On the western side of the entrance channel is:—

Inner ridge buoy, painted red and surmounted by a staff and triangle, about 4 cables south-south-west of the preceding buoy.

For the beacons and buoys marking the inner channels, *see* the plan.

NOTE.—All these buoys are moved as changes occur in the depths.

Outer anchorage (*Lat. 20° 27′ N., Long. 86° 48′ E.*).—The outer anchorage, in about 26 feet water, is three-quarters of a mile north-westward of the north point of Dowdeswell island, with the beacon on Reddie spit and Huki Tala signal staff in line bearing S. 7° W.; or in 33 feet, at about half a mile eastward of the fairway buoy, with Huki Tala signal staff bearing S. by W. ½ W.

There is also anchorage anywhere between the buoys marking the channel in 23 feet and less water according to the draught.

Small vessels can anchor in a deep hole, nearly 1½ miles long, and situated southward of Reddie point, and to the westward of the spit, the depths being from 9 to 14 feet.

The channels in the harbour are liable to change, and inclined to silt up.

Ballast must be discharged outside the limits of the port.

Directions.—From the southward, having made False point lighthouse, the water should not be shoaled to less than 10 fathoms until the lighthouse bears W.S.W., distant about 6 miles, when steer

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North until the refuge house is abeam, bearing West, when a N.W. ½ N., should lead to the fairway buoy.

With strong southerly winds the flood stream sets towards the coast about Satbaia, and vessels from the northward must guard against it.

For the inner anchorage, pass northward of the Outer spit, Inner spit, and Flat, black buoys, and eastward of the Inner ridge red buoy (taking care to guard against an eddy extending from Reddie point to the 3-fathom line). It must be remembered that Reddie point does not always show, as the spit of which it is the extremity only dries at a half ebb.

If bound to Jambu (*Lat. 21° 25′ N., Long. 86° 45′ E.*) leave the beacons on the port hand. The channel leading to Bakud creek is marked with buoys painted black on the port and red on the starboard hand, entering.

In navigating these channels, the services of a local pilot should be obtained as they alter from time to time, and changes are frequently made in the position of the buoys and bamboos which denote the fairway.

With a strong flood stream (whch may be noticed by its drifting a vessel rapidly northward) it is best to steer in on a southerly course, turning to port (east and north-eastward), so as to stem the stream before anchoring. Steam vessels steering towards Reddie point, and attempting to turn to starboard, or through south-west and north-west, with the flood stream running, have been rapidly swept across the channel to the westward, and grounded on the shoals extending from Temple point.

Boat channels.—From the inner anchorage, boat channels, winding through mudbanks and partially buoyed, lead to Bakud creek and Jambu river. There is also a channel, sometimes available for boats through mud flats and mangrove, leading to False point lighthouse, the banks on either side being marked by bamboos.

Tides.—It is high water, full and change, at Huki Tala at 9h. 18m.; springs rise 7 feet, neaps 4 feet, neaps range 2 feet. The range of tide is much affected by the fresh water out of the numerous creeks, and also by the prevailing winds; the highest tides occur during the South-west monsoon, the lowest in the dry season.

Tidal streams.—The tidal streams within the harbour set fairly through the several channels, and the rate at springs averages 2 knots an hour. After heavy rains, when the freshets come down Bakud creek and Jambu river, the ebb stream, which runs out round Reddie point, sometimes attains a rate of 4 or 5 knots an hour.

At half a mile eastward of Reddie point, the flood stream sets north; at the fairway buoy north-west; whilst midway between the buoy and

Plan 755, False point anchorage. Var. 0° 50′ E.

Reddie point, it sets west-south-west. Great attention, therefore, is necessary in entering the port with the flood stream.

In the offing, the flood sets north-east, the ebb south-west, each at a rate of about one knot an hour; but the rate is much influenced by the prevailing wind, so that the flood stream, together with the current in the South-west monsoon attains sometimes a rate of 4 knots.

Jambu location, consisting of a telegraph office, Public works department bungalow, and a Customs warehouse, is situated on the left bank of Sunta creek, and is conspicuous from the anchorage. The port officer and Customs authorities reside here.

Communication.—Steamers of the British India Steam Navigation Company from Calcutta, Madras, and coast ports usually call weekly. There are post and telegraph offices at Huki Tala on Dowdeswell island, and at Jambu.

Supplies.—Provisions are scarce and expensive; sheep and vegetables can be obtained from Cuttack, and from villages in the neighbourhood; but it is better to obtain all provisions from Calcutta by steamer. Good water can be procured at the canal lock, about a mile up Jambu river, by using boats. Firewood is plentiful and cheap.

Trade.—The port is open throughout the year, but its importance has not been appreciated till comparatively recent years. The exports consist of rice, horns, hides, and oil seeds, and imports principally of European stores.

Chart 814, The Sandheads, False point to Matla river.

FALSE BAY (*Lat. 20° 32′ N., Long. 86° 55′ E.*).—The coast from Broni Mohan creek trends north-eastward for 20½ miles to Maipara point, at Maipara river entrance, forming False bay; it is moderately high, consisting of sandhills, but from Maipara point northward it is quite flat.

Satbaia sandhill, on the coast at about 12½ miles north-eastward from Broni Mohan creek trends north-eastward for 20½ miles to eastern end, and affords a good landmark.

In the southern part of False bay, the bottom is soft olive green mud, with regular depths, decreasing gradually to the shore; but in northern part of the bay, the bottom changes from soft mud to a mixture of sand and mud, with rotten stones and broken shells towards the southern edge of the sandbanks, which extend seaward from the mouth of the Maipara river and Palmyras point.

Caution.—On nearing False point from the eastward the water shoals gradually, but in approaching the shoal ground extending east-

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Chart 814, The Sandheads. Var. 1° 0′ E.

ward from Palmyras point from the same direction, the water shoals suddenly from 13 to 9 and 4 fathoms.

Maipara river, the southern branch of the Brahmaní, enters the Bay of Bengal about 5 miles southward of Dhamra river. Bansgarh river, a tidal creek of the Maipara, runs in a south-west direction parallel to the coast till it enters the sea by Broni Mohan creek. Maipara river is deep, but its entrance is blocked by flats which can only be crossed by boats at half tide in smooth water; it is frequented from November to March by native craft engaged in the rice trade.

Long sand, on which the sea breaks heavily, is 3 miles in length in a north-east and opposite direction, its south-west end forming the eastern entrance point to Maipara river.

Anchorage.—With strong north-westerly winds there is anchorage in a depth of 7 fathoms over mud and sand, about 2¾ miles south-eastward of the northern end of the sandhills on Maipara point.

Palmyras shoals extend generally 8 miles eastward of Shortt island lighthouse, at Dhamra river entrance, and have depths of from half a fathom to 5 fathoms over them. From the southern extreme of the eastern portion of the shoals, with a depth of 4¾ fathoms, Shortt island lighthouse bears N.W. ⅛ W., distant 8½ miles, and from the north-eastern extreme of the shoals, with a depth of 3¼ fathoms, the lighthouse bears about W. by S. ⅜ S., distant 6¼ miles.

CAUTION.—Tidal streams.—The tidal streams set over Palmyras shoals at a rate of 2 knots at springs, and must be guarded against when navigating in the vicinity. On the north-eastern side of the shoals the flood stream sets about north-west and the ebb south-east. At the southern end of the shoals the flood sets north, and the ebb south.

Plan of Dhamra river on 754.

Palmyras point is the north-eastern extreme of the low land which separates Maipara and Dhamra river mouths. A mudbank fringes this coast, and dries seaward at low water for a distance of 2 miles.

The point is covered with dark jungle, and is difficult to distinguish; the surrounding land is low, with a few palmyra trees on it.

Budará pillar is situated about one mile south-south-east of the point.

DHAMRA RIVER (*Lat. 20° 47′ N., Long. 87° 4′ E.*), the most important of the navigable rivers of Orissa, forms the northern exit of the united streams of the Brahmaní, Kharsua, and Baitarani rivers. The inner bar of the river changes both in depth and

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position; but the outer bar, to the north of Shortt island, maintains its position and depth of water fairly well.

At about 9 miles from its mouth, the Dhamra forms two branches; the Baitarani, on which are situated the towns of Chandbali and Jajpur, following a westerly direction; and the Brahmaní, taking a south-westerly direction, and passing Cuttack. At about 6 miles above the Baitarani junction, Brahmaní rivers connects with the Maipara, and about 3 miles higher receives Kharsua river, which again connects with the Baitarani above Jajpur.

Plan of the entrance to Dhamra river on 754.

Shortt island, fronting the mouth of Dhamra river, and about 5 miles eastward of Palmyras point, is about half a mile square at its southern part, with two prongs stretching to the northward; it is only from 12 to 17 feet high, and sands which are continually changing, and had from 2 to 3 feet over them at low water spring tides, when last examined in 1901, extending fully a mile south and about 1¼ miles eastward.

LIGHT (*Lat. 20° 47′ N., Long. 87° 4′ E.*).—On Shortt island a *white fixed* light is exhibited at an elevation of 61 feet above high water, from a flagstaff 63 feet in height and painted black, and should be visible in clear weather from a distance of 12 miles.

Beacon.—A beacon, surmounted by a black basket, the whole 50 feet high, stands on Shortt island.

Channels.—There were two entrances to the river, the South and North channels, but the latter was closed in 1901. The South channel, about three-quarters of a mile wide at its outer part, with a shoal on which the depths are from 8 to 12 feet in mid-channel of the outer bar, passes about a quarter of a mile northward of Shortt island, where it is narrowed to that distance between banks, with less than 10 feet over them on either side.

At about 3 miles farther in it passes between extensive flats of sand and mud, which dry at low water, and about 2 miles further west is the inner bar, from which to Dhamra village, situated on the north bank, where the river is divided into two channels by Kalibhanj island, the distance is 5 miles.

Depths.—The least depth to be passed over on the outer bar is 13 feet at low water, and about 22 feet at high water springs, but on the inner bar not more than 9 feet is charted between the buoys.*

To Chandbali, up Baitarani river, the least depth is about 7 feet at low water, and 16 feet at high water springs, on Jhuta bar, about 1½ miles above the junction of the Baitarani with the Dhamra. The draught of the steamers trading to Chandbali is about 13 feet; vessels

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* Depths of 10 feet reported in this channel, April, 1910.

Plan of Dhamra river on 754. Var. 1° 0′ E.

drawing 15 feet could reach that port at high water, spring tides, and 12 feet at high water neaps.

Kanika sand.—Kanika sand, 5 feet high, and said to be extending, is situated on the northern side of the channel more than 4 miles westward of Shortt island lighthouse. A flat of sand and mud, which dries at low water, stretches one mile eastward, northward, and westward of Kanika sand.

Chandipal beacon, the triangular top of which shows over the trees, is situated about 4 cables northward of the low mud point forming the north entrance point of the river, and 2¼ miles westward of Kanika sand. *View on 754.*

Kalibhanj island, the east point of which is 2 miles westward of Palmyras point, is 4⅓ miles in length in an east and west direction, and about 7 cables in greatest width; with the shoal water extending eastward of it, as far as Palmyras point, it divides Dhamra river into two channels, the northern being navigable.

A perch stands on the northern side of the east end of the island.

Dhamra village, on the north bank of the river, 10 miles above Shortt island, consists of a few straggling houses and a Custom-house. A tide-pole indicates the depth of water on Chandipal or inner bar.

Matai river (*Lat. 20° 48′ N., Long. 86° 52′ E.*), which joins the Dhamra river at about three-quarters of a mile westward of Dhamra village, is about a cable wide and said to be navigable at low water for craft of 8 feet draught.

Buoys.—The channel is marked by red buoys with triangular topmarks on the starboard hand, and black buoys with cylindrical topmarks on the port hand, entering.

The buoys are moved as the channel alters, and their positions cannot therefore be depended on.

Outer anchorage.—With strong south-west winds there is good anchorage in a depth of 7 fathoms, with the flagstaff bearing about S.S.W. ⅜ W., distant 4 miles.

Pilots.—There are two native pilots for Dhamra river, one of whom is usually at Shortt island.

Directions.—The south channel is the only one used, and as the buoys are moved occasionally, on the channel altering, these directions must be used with caution, and it is advisable to take a pilot. In approaching Dhamra river the lighthouse by day or the light by night may be approached, bearing S.W., and, if at the latter time, anchorage taken up when in 6 or 7 fathoms.

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Chart 814, The Sandheads; plans of Dhamra river on 754. Var. 1° 0′ E.

South channel.—In rounding Palmyras shoals do not shoal to a less depth than 15 fathoms until Shortt island flagstaff bears southward of S.W. by W., when steer for the entrance to South channel, and on nearing it the coast will be seen as a low dark line of trees, with the gap, made by the channel southward of Kalibhanj island, bearing about W. by S. ¼ S.

Steer about S.W. by W. ½ W. over the outer bar, and pass northward of the black buoy at the north-western end of Shortt island shoals, having passed which keep more to the southward, leaving the red buoys on the starboard hand and pass between the red and black buoys marking the inner bar. *View on 754.*

From the inner bar the course is about West, passing southward of the low mud point, southward of Chandipal beacon, when the distant north-west extreme of Kalibhanj island should be kept just open northward of Kalibhanj perch, bearing N. 86° W. Pass the perch at a distance of a cable, and steer along, and about 1½ cables from the north coast of Kalibhanj island. When Dhamra village bears N.W. steer for the middle of the stream, and anchor with the village bearing about N.N.W. Vessels drawing 20 feet water have anchored off Dhamra.

The river above Dhamra should not be navigated without a pilot.

Baitarani river (*Lat. 20° 45′ N., Long. 86° 49′ E.*), meaning difficult to cross, enters Balasore district at Batipur village, and flows south-eastward for 45 miles till it joins the Dhamra at 9 miles from the sea. The country in the vicinity is largely cultivated with rice, and the river forms the boundary between Balasore and Cuttack.

The entrance to Baitarani river is divided into two channels by Luchinarian island, which is above half a mile in length by a quarter of a mile in breadth; the northern is the navigable channel, the southern being only available for boats.

Beacons and buoys.—Beacons stand at various points on the river, and buoys mark dangers; their positions will be seen on the plan.

Jhuta bar is formed by shoal water extending across the river from the western side of Luchinarian island to a flat, which dries, stretching about a third of a mile northward of Pilot island, situated about half a mile to the southward of Douglas point. In 1886 the depth on Jhuta bar was only 6½ feet.

Plan of Dhamra river on 754.

Pilot island, southward of Jhuta bar, is low and about 4 cables long in the direction of the river. Sand flats which dry extend northward and south-westward of it, and there is a narrow boat passage between it and the west bank of the Baitarani river, but the navigable channel, known as Pilot reach, lies between Pilot island and the east bank.

From the extreme of the spit extending south-westward of Pilot island, the river trends round Palmer point, north-westward of which and on the western side of the river is Sickle island, a bank which dries at low water.

The navigable channel lies close to the eastern side of the river, and curving westward crosses to the south bank at Sickle point, the eastern end of Long reach.

Long reach is about 2 miles in length, and bends round Borarria point, which is low; it terminates northward on Hurripur bar, which has about 8 feet at low water over it.

Hurripur reach trends northward, and the deepest water is in mid-stream; its upper part trends westward round Love point.

Love point bar extends about 4 cables westward of Love point, and has depths of from 7 to 8 feet over it. The deepest channel is a quarter of a cable from the south bank up Love reach, until travellers' bungalow bears North, distant about a cable, and thence in mid-stream.

Tides.—It is high water, full and change, at Shortt island at 9h. 45m.; at Kanika bank at 9h. 30m.; and at Chandbali at 11h. 0m.; at Shortt island springs rise 9½ feet, neaps 6 feet.

The tides are subject to a large diurnal inequality, which may either accelerate or retard the times of high and low water, sometimes to the amount of an hour or more.

From September to March, inclusive, the night tides are higher than the day tides; in December and January, at springs, the difference is about 2 feet.

From March to September, the day tides are higher than the night tides, and the difference is greatest in June and July, at springs.

A tide gauge is situated about 6 cables north-westward of Shortt island flagstaff; there is a tide pole south-westward of Kanita sand and another off Dhamra village.

CHANDBALI (*Lat. 20° 47′ N., Long. 86° 43′ E.*), on the north bank of the Baitarani river, 20 miles from its mouth, has decreased in importance owing to the opening of the Bengal-Nagpur railway, but still possesses a large trade; it is considered within the port of Dhamra. There is a police station, travellers' bungalow, and Custom-house with warehouse; also three landing piers, which have each a depth of 10 feet at their ends. The population of Chandbali in 1901 was 1,826.

Plan of Dhamra river on 754. Var. 1° 0′ E.

Anchorage.—The anchorage, in from 22 to 30 feet, is in front of the town.

Communication.—There is communication with Calcutta by steamer four times a week; and with Cuttack by canal or road.

Supplies of fresh provisions can be obtained at Chandbali in small quantities.

Storm signals are shown from a staff near Chandbali Custom-house. *See* pages 74-76.

Trade.—The sole export is rice; the imports are piece goods, cotton twist, kerosene oil, salt, spices, and gunny bags. There is only a coasting trade at Chandbali, conducted principally in light-draught steamers; native vessels carry on a small trade in rice during the North-east monsoon.

Guire point (*Lat. 20° 46′ N., Long. 86° 43′ E.*), a sharp point on the south bank of the river, about 3 cables westward of Chandbali, terminates Love reach. Here the river turns sharply south-eastward, and is navigable 2 miles further for vessels of a draught that can reach Chandbali.

Mahurigaon, situated 2 miles above Chandbali, on the east bank of the river, is unimportant.

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CHAPTER VI.

BALASORE, SUNDARBANS, AND CHITTAGONG COASTS, WITH HÚGLI, MATLA, AND MEGHNA RIVERS.

(Lat. 20° 47′ N. to lat. 21° 11′ N.)
(Long. 86° 58′ E. to long. 92° 3′ E.)

Variation: Decreasing about 3 minutes annually.

Chart 814, The Sandheads, False point to Matla river. Var. 1° 0′ E.

BALASORE DISTRICT.—The Baitarani river is the southern boundary of Balasore district, which has a coastline of nearly 80 miles, and contains the ports of Balasore and Subarnarekha. *See* Chapter I., page 33.

Coast (*Lat. 20° 47′ N., Long. 86° 58′ E.*).—From Dhamra river entrance the coast trends northward for a distance of 4 miles to the sandy Balisai point; flats extend well off this coast, and there is a depth of 3 fathoms at from 6 to 7 miles eastward of it. The coast then has a north-north-west direction for 13 miles to abreast of Bidiapur, and is low, muddy, and wooded with small scrub; the 3-fathoms contour line is from 4 to 5 miles from this part of the coast, and landing is difficult owing to the softness of the mud.

About 3 miles northward of Bidiapur the coast trends northward, and as far as Kalikoti, 7½ miles from Bidiapur, is flat and faced with low mangroves. Eastward of Kalikoti the 3-fathoms contour line is 5½ miles from the mangrove edge, and the bottom is soft olive-coloured mud.

At 2 miles northward of Kalikoti the coast turns to the north-north-eastward, and 9 miles further in that direction is Nauri, with mud and sand flats extending off it, and about half way between these places a large double pagoda shows out amongst the trees on north-westerly bearings; the Calcutta coast canal to Cuttack runs along a few miles within the coast. At Nauri the coast becomes firm, with higher trees and sandhills, and so continues for 10 miles to Chandipur.

Gammai river, a small stream, enters the sea one mile southward of Kalikoti, and another stream debouches just south of Nauri; both are inaccessible at low water to anything but small boats.

At Chandipur is a large white bungalow with a black flagstaff near it, whence low sandhills continue 1½ miles to Burhabalang river entrance.

The coast near the mouth of Burhabalang river appears from the offing to be sandy and barren.

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Plan of Balasore road and river on 239. Var. 1° 0′ E.

BALASORE ROAD is resorted to in the North-east monsoon for cargoes of rice, which are brought down Burhabalang river. The largest vessels which ascend to Balasore or receive their full cargo in the river are of about 145 tons.

LIGHT (*Lat. 21° 26′ N., Long. 87° 2′ E.*).—A *white fixed* light is exhibited, at an elevation of 62 feet above high water, from Chandipur flagstaff, 20 feet in height, and painted black, and should be visible in clear weather from a distance of 10 miles.

Anchorage.—Directions.—A vessel of 20 feet draught will find the best anchorage in a depth of 4 fathoms, over a bottom of sand and stiff mud, and good holding ground, with Chandipur flagstaff bearing N.W. by W., distant nearly 7 miles.

Anchorage may also be obtained with the flagstaff bearing N.W. ⅝ N., distant about 4¼ miles, in a depth of 3¼ fathoms. (*View on 239.*)

The anchorage should be approached with the highest part of Nílgiri hills, about 15 miles inland, bearing about W.N.W.

BURHABALANG RIVER, rising in the Mayurbhanj hills, after receiving the Gangahar and Sunai tributaries, flows into the sea at Balasore road; the river is tidal for a distance of 23 miles, and native craft and steamers of 9 feet draught navigate to the town of Balasore, about 16 miles from the entrance. Jimkhana bar, about a mile below Balasore, extends between sandbanks, and has from one foot to 2 feet at low water over it.

Entrance channels.—Depths.—The entrance to the river, 2 cables in width, is almost closed by a bar extending seaward for about 2½ miles, over which there are two channels. The southern of these, which is about a quarter of a mile in width at its narrowest part, passes south-westward and westward of Elfin flat, and had a least depth of 2 feet on the leading marks in 1901, but in 1902 was described as being practically dry at low water.

What is known as the New channel, which has a straight north-west direction, passing north-eastward of Elfin flat, is dry at low water, and the bar is liable to deteriorate during the South-west monsoon, and with a south-east wind breaks right across; the last quarter flood is the best time for crossing.

As the rise at neaps is only 8 feet, and at springs from 11 to 13 feet, these are the greatest depths to be expected under favourable circumstances at high water.

Beacons.—At about half a mile north-eastward of Chandipur flagstaff are two transit marks, which do not appear to be used for navigation at present.

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Plan of Balasore road and river on 239. Var. 1° 0′ E.

On the western side of Burhabalang river entrance are two beacons, the inner being surmounted by a white and the outer by a black globe, which, in line, lead through the New channel, but they are shifted as the channels alter.

On the eastern entrance point of Burhabalang river is a wooden spar painted white, surmounted by a basket, 35 feet above the ground.

Buoys.—Anchorage buoy, black, surmounted by a staff and cage, and with, on one side, an anchor, on the other letter B, painted white, is moored in a depth of 28 feet at low water spring tides 6¼ miles S. by E. ½ E. from Chandipur flagstaff. By noting the depth at the anchoring buoy and comparing with the plan, the depth on the outer bar and in the river generally may be estimated.

The fairway buoy, painted black and white in horizontal stripes, and surmounted by a pole, is moored in a depth of 12 feet about 3⅔ miles eastward of Chandipur flagstaff.

In the southern entrance channel are the following buoys:—

A buoy, painted red and surmounted by a staff and triangle, moored in about 9 feet at low water $2\frac{6}{10}$ miles east-south-east of Chandipur flagstaff.

A square buoy, painted black and surmounted by a staff and cross, moored in about 3 feet water nearly 1½ miles east-south-east of the flagstaff.

A conical buoy, painted red, moored in about 5 feet water $1\frac{2}{10}$ miles eastward of the flagstaff.

A conical buoy, painted black and surmounted by a pole, situated about a quarter of a mile south-south-eastward of the entrance to the river.

In the New channel, a nun buoy, painted black and surmounted by a pole, is moored about one mile south-eastward of the entrance to the river, and on the north-east edge of Elfin flat.

A tide gauge (*Lat. 21° 28′ N., Long. 87° 3′ E.*) is placed 5½ cables inside the entrance of Burhabalang river, and near the south bank; about a cable westward of it is the landing pier, from which a road leads to Balasore town.

Directions.—As changes occur in the channels, the beacons and buoys are also changed, and the following directions must be used with caution.

Entering by the southern channel, bring Chandipur flagstaff to bear W.N.W. and steer for it, which should lead northward of the red conical and square black buoys, and when the spar beacon, surmounted by a basket and situated on the eastern entrance point to

General charts 829, 70.

the river, bears N. ¼ E. alter course for it, which should lead to the entrance to the river passing westward of the red buoy and eastward of the inner black buoy.

By the New channel, the beacons on the western side of the river entrance in line bearing about N. 48° W. should lead to the inner black buoy off the entrance to the river.

Great caution must be used in taking the bar as the channel is always liable to shift, and when crossing the bar, if the flood stream is running, a vessel must guard against being set northward.

The channel in the first reach of the river, which has a westerly direction, is near the northern bank until abreast Chota Ghira point, where the river takes a very sharp turn to the southward, and the channel is near the east bank.

This reach, 1¼ miles in length, gradually curving round to the south-westward, has depths of from 7 to 9 feet at low water, increasing to 15 and 21 feet in its southern part, and the river now turns westward, and, rounding a point with deep water in the bend, turns nearly parallel, but in an opposite direction, to that before; the channel is on the south side in the bend, and on the eastern side in the next reach, till approaching Ghentí point, where mid-channel should be kept; the depths here are from 9 to 26 feet.

The river from Ghentí point winds westward, and at 7 cables westward of Ghentí point it is obstructed by Dinga flat and bar; when passing the former the north bank of the river must be closely followed, and Whoarguddi, the next reach, must be opened slightly before crossing the bar, on which there are depths of from 6 to 7 feet at low water. Small bamboo marks are placed for navigating this part of the river. Dinga bar passed, the channel is on the south bank, and is deep until Whoarguddi is approached, where there are depths of 10 and 11 feet.

Jungle point (*Lat. 21° 29′ N., Long. 87° 0′ E.*) is the end of Whoarguddi reach, and the river here takes a sharp trend to the eastward for 1¼ miles, with depths of from 9 to 18 feet to Chargutia point, after rounding which the river turns westward for 1¾ miles to Bubur point. The depth of this part of the river is from 3 to 10 feet at low water, the channel passing south of a detached sandbank, and then crossing to the north bank; again crossing to the south shore, as Bubur point is approached.

From Bubur point the river turns abruptly to the northward for a mile, and a sandbank, 4 cables long and three-quarters of a cable broad, blocks up the greater part of it; the navigable channel, which is on the western side, has depths of 3 feet. This part of the river is known as Bubur bar. The river then winds round Nudiafa point, and

Plan of Balasore road and river on 239. Var. 1° 0′ E.

trends south-south-westward for a mile to Pukarabhar, then westward for 7 cables to Jimkhana, and again south-westward for 5½ cables to Muhammad Pau, rounding which Balasore port is reached.

Jimkhana bar, of sand, with a depth of one foot over it at low water, spring tides, is midway between Pukarabhar and Jimkhana.

About 2 cables north-eastward of Muhammad Pau the channel of the river crosses to the west bank, on which side it continues to the Custom-house at Balasore, a distance of 3 cables. Depths here vary between 10 and 22 feet at low water, spring tides.

Balasore port, about three-quarters of a mile in length, fronts Balasore town. North-eastward of the Custom-house at Balasore there is a depth of 10 feet at low water, but the river is only half a cable wide, and a vessel must be moored head and stern.

Tides.—It is high water, full and change, at Burhabalang river entrance, at about 10h. 0m.; springs rise 11 to 13 feet; neaps 8 feet. At Balasore town it is high water, full and change, at about 11h. 0m.; springs rise 10 feet; neaps 6½ feet.

Tidal streams.—In Balasore road the tidal stream sets south-westward during the falling tide, and north-eastward during the rising tide; the rate of each stream being about 2 knots an hour at springs.

In the river the ebb or out-going stream lasts 8 or 9 hours, and runs as much as 4 knots an hour; the flood or in-going stream is feeble, averaging about half a knot.

BALASORE TOWN (*Lat. 21° 30′ N., Long. 86° 56′ E.*), the first place in Bengal occupied by the British, owes its importance to the safety of its roadstead, and, although it includes an extensive bazaar, is little more than a collection of hamlets covering an area of 5 square miles.

Besides the usual public offices, are a district jail, general hospital, and charitable dispensary, and the railway bridge over the Burhabalang is an imposing structure; in 1901 the population was 20,880.

Farasdanga, a small area on the south side of the river below Balasore, is a French possession.

Communication.—Steamers of the Indian General S.N. Company call weekly, and moor head and stern off the Custom-house. Balasore has also railway and telegraphic communication.

Supplies.—Provisions for vessels at Balasore road can be procured by arrangement, either with the owners or cargo boats, or with the masters of the small steam vessels which ply to Calcutta. Fresh water is obtainable, but it is not good; the river water off Balasore town at half ebb is fit for drinking.

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Plan of Balasore road on 239. Var. 1° 0′ E.

Trade.—The principal exports are rice and stoneware, quarried chiefly in the Nilgiri hills; and imports, cotton twist, European cotton piece goods, kerosene oil, and salt.

Large vessels load in the roads during the North-east monsoon.

Storm signals are shown at Balasore. *See* pages 74-76.

Cyclonic storms.—Balasore roadstead is in the track of cyclonic storms, and many disasters have been caused by them. Native craft approach the coast as near as high water will permit in threatening weather, and should a storm come on it is said they have little to fear. A vessel in doubt as regards weathering a storm might run into the western part of Balasore road, near Kalikoti, where the bottom is soft mud, and shoals gradually.

Chart 814, The Sandheads.

COAST.—Panchpara Nud is a river situated 4½ miles north-eastward of Burhabalang river, and near its mouth are sandhills of mottled grey and yellow colour; it bifurcates just within its entrance, and Chanuya village lies about 5 miles up the western, and Sartha about 8 miles up the eastern, branch.

The bar has only a depth of about one foot on it at low tides, but within the river is deeper, and native vessels of 100 tons enter and ascend as far as Mahadani, 9 miles inland. The villages export rice and paddy.

From Panchpara Nud the coast, with several sandhills on it, trends 12½ miles in an east-north-east direction to Subarnarekha river mouth, off which, at a distance of about 2 miles from it, is Pippli sand, which dries.

Subarnarekha port (*Lat. 21° 34′ N., Long. 87° 20′ E.*) is almost choked by sandbanks; on the western side of the river entrance stand a pagoda and tope of trees (not charted). On the left bank, about 20 miles from the sea, is Jaleswar (Jellasore), a village on the Calcutta high road. The port is principally visited by fishing boats, which in fair weather sail in numbers together as far as Purí.

Channel.—The channel, nearly dry at low water, is on the south-western side of Pippli sand, and within the river is said to be fairly deep, and navigable for country craft for about 16 miles, to which distance it is tidal, and studded with islands. During the rains, rice boats of about 2 tons capacity penetrate far up the Subarnarekha, which has a tortuous course of 296 miles.

Anchorage.—There is anchorage off Subarnarekha river mouth in depths of from 4½ to 5 fathoms, over muddy bottom, with the pagoda bearing N.W. by N. and 8 miles from the shore.

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Chart 814, The Sandheads. Var. 1° 0′ E.

Communication.—Jaleswar is a station on the Bengal-Nagpur railway.

COAST.—From the Subarnarekha river the coast trends east-north-eastward for about 10 miles to Birkul bungalows, and is generally sandy; between is Quoin sandhill. At 3 miles eastward of Birkul bungalows is the mouth of Digwah Mohan, a shallow stream, and at 4 miles farther that of Munder Mohan, which is similar.

Several creeks, including Sola creek, then occur, and at about 16 miles from Munder Mohan is Rásulpur river mouth; all this coast is low and without any distinguishable marks. The small vessels that frequent Rásulpur river, in their passage from the westward, use a narrow channel close in-shore, which has depths of from 3 to 6 feet, but requires local knowledge.

MIDNAPORE DISTRICT, beginning at Birkul bungalows, extends for about 50 miles along the western bank of the Húgli river. *See* Chapter I., page 34.

GEONKHALI (COWCOLLI) LIGHT.—A *white fixed* light is exhibited, at an elevation of 75 feet above high water, from a brick tower, 80 feet in height, and painted white, on the western side of Húgli river entrance, and about 2 miles from Khijiri semaphore; it should be visible in clear weather from a distance of 15 miles.

THE PILOTS RIDGE, a bank extending off the coast between False and Palmyras points, affords an excellent guide in approaching Húgli river, as the bottom, in depths of less than 20 to 23 fathoms, is shelly sand and gravel of a reddish colour, while in deeper water to the east or seaward, it is sand and mud with shining specks, or olive-coloured mud with broken shells. The eastern edge of the ridge is rather steep, the soundings seaward of it being from 28 to 30 fathoms.

The 20-fathoms contour line trends north-east, and from about 22 miles eastward of False point lighthouse passes 25 miles eastward of Palmyras shoals.

HÚGLI RIVER APPROACH.—LIGHT-VESSELS.—In Húgli river approaches, light-vessels exhibit a *white* light from the forestay at 6 feet above the rail, for the purpose of showing in which direction the vessel is riding when at their stations. When a light-vessel is driven from the position assigned, to one useless as a guide to shipping, the usual lights are not shown, but a *red fixed* light is exhibited from each end of the vessel, and a *red* flare burnt every quarter of an hour; by day the balls or other distinguishing masthead marks are struck, and the name covered over.

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Chart 814, The Sandheads. Var. 1° 0′ E.

If from any cause a light-vessel in position is unable to exhibit all the usual lights, the riding light is shown and any of the usual lights that can be exhibited. Explosive rockets fired from a light-vessel indicate need of assistance from shore.

NOTE.—Apparent time is kept on board the light-vessels.

PILOTS RIDGE LIGHT-VESSEL (*Lat. 20° 52′ N., Long. 87° 52′ E.*) is painted red, with *Pilots ridge* in white letters on the sides, and has three masts, with a black ball and a half ball, flat side up, over it at the main masthead; the vessel is moored in 26 fathoms.

The light-vessel exhibits, at an elevation of 44 feet above the level of the sea, a *white flashing* light, with a period of system of *one minute*, showing:—flash, *ten seconds;* eclipse, *fifty seconds;* it should be seen from a distance of 12 miles in clear weather. A blue light is burnt every hour between sunset and sunrise from 15th March to 31st October.

Fog signal.—A fog bell is sounded at intervals of not more than *two minutes.*

Buoy.—The station buoy, conical, painted white, with P.R. in the centre of a black oval painted on the side, and surmounted by a white open basket, is moored in 24 fathoms water at one mile north of Pilots ridge light-vessel.

Tides.—It is high water, full and change, at Pilots ridge at about 9h. 50m.; springs rise 9 feet, neaps 7 feet, above lowest low water at extraordinary springs; neaps range 5 feet 9 inches (computed between March and September, approximate only).

Tidal streams.—From the end of June to the end of November, there is little or no flood or westerly stream off False and Palmyras points except at springs, but there is often a strong outset, caused by freshets from the rivers.

Seaward of the Sundarbans there are strong rotatory streams; the flood begins running westward, at the end of the first quarter its direction is west-north-westward, at half flood it runs about north, and during the last quarter east-north-eastward. At the commencement of the ebb stream it sets east, at half ebb it runs southward, and during its last quarter west-south-westward; thus making a complete rotation.

EASTERN CHANNEL LIGHT-VESSEL (*Lat. 21° 0′ N., Long. 88° 12′ E.*), painted red, with Eastern channel in white letters on the sides, has one mast with a black ball at the masthead, and is moored in 10 fathoms at the entrance of Eastern channel. The light-vessel exhibits, at an elevation of 44 feet above the water, a *white flashing* light, with a period of system of *thirty seconds*, show-

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Chart 814, The Sandheads. Var. 1° 0′ E.

ing thus:—flash, about *five seconds;* eclipse, about *twenty-five seconds;* which should be seen from a distance of 12 miles in clear weather.

From 15th March to 31st October a blue light is burnt every half hour between sunset and sunrise, and from 1st November to 14th March, a blue light is burnt every hour between sunset and sunrise.

Fog signal.—During thick or foggy weather a fog bell is sounded at intervals of not more than *two minutes.*

Buoy.—The station buoy, conical and painted white, is moored about one mile northward of Eastern channel light-vessel.

Tides.—It is high water, full and change, at Eastern channel light-vessel at 8h. 43m.; springs rise 10¾ feet above lowest low water at extraordinary spring tides; neaps rise 8 feet; neaps range 4 feet 6 inches.

Tidal streams.—In Eastern channel the tidal streams set as follows when uninfluenced by the wind:—

Flood.		Ebb.	
1st Quarter	N.W. by W.	1st Quarter	S.E. by E.
2nd Quarter	N.N.W.	2nd Quarter	S.S.E.
3rd Quarter	N.N.E.	3rd Quarter	S. by W.
Last Quarter	E.N.E.	Last Quarter	S.W. and W.S.W.

The streams generally run in the directions of the channels, at rates of from 2 to 3 knots at springs, and one knot to 1½ knots at neaps.

South channel buoy (*Lat. 21° 2′ N., Long. 87° 59′ E.*), with S.C. painted on it, and surmounted by a basket, is moored in a depth of about 10 fathoms, N.N.E. ⅝ E., distant 12 miles from Pilots Ridge light-vessel, and 13 miles westward of Eastern channel light-vessel.

PILOT VESSELS.—Cruising station.—A steam pilot vessel, painted white, with three masts and a yellow funnel, also brigs of about 300 tons, painted black, with stripes and imitation ports, cruise off the entrance to the River Húgli: the steam pilot vessel communicates by wireless telegraphy with the lighthouse on Sagar island.

During the South-west monsoon the vessels endeavour to cruise about 8 miles south to south-west of the Eastern channel light-vessel, and in very strong winds and a heavy sea about 10 miles, the supply brig, as a rule, taking the outer position. During the North-east monsoon they cruise or anchor from 2 to 3 miles S. by W. to S.W. of the same light-vessel.

If a pilot is not taken at the cruising station one cannot be obtained inside the river.

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Chart 814, The Sandheads. Var. 1° 0′ E.

Pilotage.—Draught.—Pilotage is compulsory for all merchant vessels over 100 tons, the pilots being paid according to the vessel's draught, the maximum draught that is taken up the river being probably 28 feet.

Signals.—The vessel which will supply a pilot to an inward-bound vessel flies a large blue flag at the main if the vessel is under weigh, and if at anchor a blue pennant is hoisted, but at the mizen, and by night shows a flare-up light at short intervals; the vessel showing these signals should be closed without delay, unless prevented by heavy weather.

On an inward-bound vessel arriving at the Sandheads, and not finding a vessel showing the above signals, it will be understood that there are no pilots on the station, and a careful lookout must be kept for any signals that may be made, which will generally be by the nearest pilot vessel.

Wireless telegraph.—The pilot vessel at the Sandheads is in direct communication with Calcutta by wireless telegraph.

Approach (*Lat. 21° 0′ N., Long. 88° 12′ E.*).—**Directions.**—Vessels approaching the station must make the usual signal for a pilot, and inward-bound steam vessels should indicate their tonnage by the following steam whistle signals:—

Over 3,550 tons gross - - -	One short blast.
Between 3,000 and 3,550 tons gross -	Two short blasts.
Between 1,950 and 3,000 tons gross -	Three short blasts.
Under 1,950 tons gross - - -	Four short blasts.

Sailing vessels should indicate their net tonnage.

Sailing vessels should not run for the station at night or in threatening weather, but under such circumstances put the vessel under easy sail while in deep water, and keep the sea. The lead should be used frequently.

Steam vessels, finding the steam pilot vessel at the station, should close to a distance of about 1½ cables under that vessel's stern, heading in a similar direction and in such a manner as to make a lee for the pilot boat.

Sailing vessels arriving at the cruising ground, known as Sandheads, and finding the pilot vessel at anchor, must use the utmost caution in closing her on account of the strong tidal streams. When easterly winds prevail there is a strong set to the westward; it is then specially incumbent on strangers to be guided by the advice given from the pilot vessel.

A sailing vessel arriving at night should not heave-to to windward of the brig if intending to take a pilot before daylight, but close as soon as possible, approaching round the brig's stern, whether at anchor or under weigh.

In August, September, and October, when sailing vessels are signalled to keep to windward from there being no pilots or other causes, they should be most careful to keep the Eastern light-vessel in sight, using a kedge anchor if the wind falls light, to prevent drifting off the station.

Signals from the pilot vessels to prepare for bad weather should not be ignored.

The tidal stream should be studied; with the first of the flood setting to the westward, a vessel should stand to the eastward, and the first of the ebb setting eastward, stand westward and northward.

Strangers anchoring below or at any distance off the light-vessel should endeavour to near the brigs, and not remain at anchor; a kedge anchor is useful.

The practice in a sailing vessel of rounding the brig close-to, in a sea-way, is dangerous, both to the brig and to the boat alongside, as, on being brought to the wind the vessel may make a rapid stern board on to the brig, rendering it difficult for the latter to get clear, and in the case of the boat it may be liable to be swamped.

Lloyd's agents at Calcutta have facilities for delivering orders at the Sandheads.

CAUTION.—Should it be necessary when aproaching Húgli river (the Sandheads) in heavy weather to anchor from any cause, a berth should, if possible, be taken up outside the line joining Eastern channel and Matla light-vessels in a depth of not less than 15 fathoms, over mud bottom, and the pilot vessels should not be closed until the weather moderates.

Less strain will be brought on a vessel's cable, and riding will be easier, if anchored in depths of from 15 to 20 fathoms, than in less water, especially in an estuary; the cable is never quite taut in the greater depths, and therefore is not so liable to part, and the sea has less force than when in shoaler water.

Directions.—Sailing vessels approaching Húgli river.—In the South-west monsoon it is best to make the Orissa coast about Pundi (*Lat. 18° 40' N., Long. 84° 27' E.*), or between it and Ganjám, where it is high, for in the latter part of March, and early in April, the weather is generally hazy, obscuring the land until very near; it is unadvisable to get northward of Purí before the position is ascertained.

The bank of soundings affords a valuable guide in approaching this coast, the 100-fathoms contour line being about 23 miles south-eastward of Pundi and Ganjám, and about 15 miles off Purí.

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Chart 814, The Sandheads. Var. 1° 0′ E.

At night make either Kalingapatam, Gopalpur, or Purí lights, using the lead continually in closing the land, and observing that the 20-fathoms line is only 3 miles off Ganjám, and 12 miles south-eastward of Purí. When the position is ascertained, steer along the coast in depths of 18 or 20 fathoms at night, or with unsettled weather; with daylight and clear weather, sight Jagganáth and Black pagodas in passing.

By night the depth should not be shoaled to less than 15 fathoms, as, the coast being low, it cannot be seen unless close-to, and in hazy weather the noise of the surf would possibly be the first indication of being near it.

When about 10 miles past Black pagoda steer for Pilots ridge light-vessel, paying particular attention to the lead when passing False point, as the depths decrease gradually towards the bank surrounding it; but by night a vessel should not be in less depth than 14 or 15 fathoms, or even that of 20 fathoms if the wind is south-easterly; the tidal stream of the flood inclines towards the land, and that of the ebb away from it.

Having made Pilots ridge light-vessel (*Lat. 20° 52′ N., Long. 87° 52′ E.*), Eastern channel light-vessel may be steered for, and low water is the most convenient time for a vessel of deep draught to arrive at the latter, as the difference between the time of high water at Eastern channel light-vessel and at Calcutta enables such a vessel to arrive at the latter place in one tide.

Towards the close of the South-west monsoon, or in September, as the wind often hangs to the eastward and the current sets strong to the south-westward, if the position can be ascertained do not make the land so far to the southward.

In the North-east monsoon, if on the east side of the Bay of Bengal, steer direct for Eastern channel light-vessel; or when near the head of the bay, work up, making short tacks southward of that light-vessel.

Special quarantine regulations.—A vessel arriving at the Sandheads from an infected port, or having plague on board, or a vessel on board which one or more cases of plague have taken place within 12 days of the date of arrival, shall hoist and keep flying a yellow flag and the signal indicating the port left, until permitted, in writing, by the health officer to haul them down.

During this period no communication shall be held with the shore, or with any other boat or vessel, with the exception of the boat supplying the pilot, his leadsman, servant, and baggage.

In the case of a vessel with any case of sickness on board which the pilot has reason to believe to be plague, he shall telegraph to the health officer from Sagar, and not proceed beyond Diamond

Chart 814, The Sandheads. Var. 1° 0′ E.

harbour without permission of the health officer. If the pilot has no reason to believe that there is any one suffering from plague on board, he shall bring the vessel up the river to Matia Buruj, and anchor her there until visited by the health officer.

Vessels with cases of smallpox, cholera, measles, or other epidemic diseases common in India, or of diphtheria, or scarlatina, on board, or, if two or more deaths from suspicious causes have occurred during the voyage, are to report the cases to the pilot immediately he boards the vessel, when he will give instructions as to the signals to be hoisted.

The sanitary station is at Diamond harbour.

Winds and weather.—The wind and weather prevalent at the Sandheads is given in the following table:—

Month.	Wind.	Force.	Weather.	Remarks.
September After breaking up of South-west monsoon.	Easterly	Light and variable.	Showers of rain	Westerly current depending on force and duration of easterly winds. Weather generally clear.
October	Easterly and calms.	Variable	Stormy, sultry at times.	Westerly and south-westerly current. Generally a gale or cyclonic storm.
November, December, January.	Northerly in morning and evening.	Fresh in morning and evening, calm midday.	Fine weather with cool mornings and evenings.	Cessation of the strong tides of the Húgli. Fogs in January in morning.
February	Variable, southerly at night. North-westers sometimes.	Light	Warm towards end of month.	Thick fogs in morning. Floods strong in Húgli towards end of month.
March, April, May.	Variable, until end of March; westerly and south-westerly in April and May.	Light at first, sometimes strong at end.	North - westers, with rain, thunder and lightning, frequent. Hazy.	Flood tide occasionally accompanied by bore. Sometimes a gale or cyclonic storm in April or May.
June	South-west	Strong at first	North-westers decreasing in force. Heavy thunderstorms.	In June the "chota bursat" or small rain generally lasts a fortnight.
July	South-west Westerly	Strong Gales frequent.	Squally, heavy rains.	Freshets in the river. Much swell in Eastern channel.
August	South-west and westerly. Westward during day, hauling to southward towards evening.	Lighter	Do. Generally clear.	Strong westerly current at Sandheads.

Chart 136, River Húgli.

HÚGLI RIVER (*Lat. 21° 14′ N., Long. 88° 11′ E.*), the western, and for commercial purposes the most important, channel by which the Ganges enters the Bay of Bengal, is formed by the con-

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fluence of the Bhagirathi, Jalangi, and Matabhanga, the first deltaic offshoots from the Ganges, and known as the Nadia rivers. The Húgli commences at the confluence of the Bhagirathi and the Jalangi opposite Nadia, about 79 miles above Calcutta; the Matabhanga joins the Húgli about 40 miles lower down.

The Húgli may be divided into two portions, namely, the river proper from Nadia to Kantabaria, and the estuary from Kantabaria to the mouth beyond Sagar island. The navigable channel in the river is subject to annual variations, caused by the difference in direction of the scour of the freshets and flood stream respectively during the rainy and dry seasons, whilst the channel through the estuary is subject from time to time to changes across the whole of its width, such as occur in all wide, sandy, tidal estuaries in their natural condition.

In some parts of the river the changes in depths and in the directions of the channels are very rapid, and it would serve no useful purpose to attempt any description of the channels, bars, or depths, which, although correct when writing, might afterwards be altogether changed in the shortest possible time.

On the left bank, the Húgli is connected by tidal channels with the various distributaries by which the Ganges enters the sea; some of these forming waterways for boat and steamer traffic from Calcutta through the Sundarbans to Eastern Bengal and Assam. For practical purposes the sea may be said to be about 83 miles from Calcutta, but the Eastern channel light-vessel lies about 122 miles from Calcutta. At the entrance the river is about 11 miles in width, between the coast near Bankiput and the south-west end of Sagar island.

Depths.—To Sagar roads (*Lat. 21° 38′ N., Long. 88° 0′ E.*), the least depth to be passed over from the bay, by Eastern channel, is about 14 feet at lowest water, and about 26 feet at high water neaps, situated on Middleton bar in Gaspar channel, and the bar in Moyapur reach had apparently depths of from 13 to 14 feet in 1909.

The Húgli, to Calcutta, can be navigated by vessels of 28 feet draught at high water springs, and 24 feet draught at high water neaps, from June to October, when the river is high; and by vessels of 26 and 22 feet draught at those times of tide, from October to June, when the river is low, with normal conditions of bar.

The plan of the river cannot be depended on, and the positions of light-vessels and buoys are shifted as necessary.

Buoys.—Proceeding up the Húgli starboard hand buoys are red, surmounted by a black staff and triangle; port hand buoys are black, surmounted by a black staff and cylinder. The buoyage is in accordance with the uniform system of India. *See* page 84.

Chart 136, River Húgli. Var. 1° 0′ E.

Húgli river tides and tidal streams.—The tide in the Bay of Bengal in front of the mouths of the Ganges rises in different parts from 9¼ to 11 feet at the highest ordinary springs, attaining its greatest range of 11 feet at the Eastern channel entrance, and the range of neaps at the same point is 4½ feet.

The tidal range gradually increases in converging to the Húgli estuary and ascending the narrow channel. At Dublat, near the south-eastern corner of Sagar island, the mean range of greatest ordinary springs is 14 feet 2½ inches; and the highest spring tides in each month, throughout the year, have an average range of 16 feet, and the lowest neap tides 3 feet 9 inches.

At Diamond harbour (*Lat. 22° 11′ N., Long. 88° 11′ E.*), the mean range of greatest ordinary springs is 15 feet 9½ inches, the maximum monthly range averages 17 feet 8 inches, and the minimum 5 feet 9 inches; whilst at Kidderpur, the mean range of greatest ordinary springs is 11 feet 8½ inches, and the range of the maxima and minima tides in each month averages 12 feet 9½ inches and 5 feet respectively.

The tidal influence at high springs during the dry season extends about 5 miles above Nadia, or 181 miles from Húgli mouth. The highest tides are at night from November to February, and by day from March to October.

The strong southerly winds, which prevail from March to September, drive the water into the river, and raise its mean level in August and September, when the river is highest, 4 feet higher than in February and March, when the river is lowest, the northerly winds, which prevail from November to February, driving the water out of the river.

The large fresh-water discharge of the Húgli during the rainy season has very little influence on the tidal range in the estuary up to Húgli point during spring tides, as the high and low water levels are both raised one foot to 2 feet above their levels of the dry season.

Above Húgli point the influence of the freshets in checking the tidal influx, even at springs, becomes marked in the comparatively narrow channel, and in ascending the river, the tidal rise becomes more and more a backing up of the fresh-water discharge, so that at Calcutta, the out-going stream is only occasionally reversed at high springs during the height of the freshets.

The chief influences of the freshets on neap tides are manifested by a raising of the low water level and a reduction in the tidal range as compared with the dry season. Low water of a low neap tide at Kidderpur is raised by the freshets to about the level of high water of a similar tide in the dry season.

The tidal wave takes 5h. 19m. travelling from Eastern channel light-

General charts 829, 70.

vessel to Calcutta, its rate of progress being 44 miles an hour at that light-vessel, and 18 miles an hour at Calcutta.

The strength of the tidal streams varies in different parts of the river and at different times of the year; their rate is least during the North-east monsoon from November to February, when it is 3 to 3½ knots an hour at springs, and 1½ to 2 knots at neaps.

During the latter part of the dry season, the South-west monsoon blowing in the direction of the flood stream increases its rate, so that it flows up the river at 4 to 6 knots an hour during springs from March to June.

The descent of the freshets from July to October causes the ebb stream to predominate, which reaches at that period a maximum rate during springs of 6 knots, whilst the flood is obliterated, except in the estuary.

Accordingly, as regards the tidal streams in the Húgli, there are three distinct periods in a year, lasting approximately four months each. During the cold season the flood stream has a slight preponderance over that of the ebb, owing to its shorter period of flow; during the second half of the dry season, the flood stream is considerably stronger than the ebb stream, being driven by the South-west monsoon; whereas during the rainy season the flood stream is overpowered by the descent of freshets which gives a great predominance to the ebb stream. *See* also pages 299, 300, 304, 305.

Bore.—The opposition to the influx of the tide along the upper part of the Húgli is manifested by the appearance of a bore at high spring tides. The shoals and sharp bends in the river appear to be the causes of the checking of the progress of the flood stream, which results in the creation of the bore.

The bores in the Húgli occur only on the highest, or at alternate spring tides; their appearance may, with certainty, be predicted by the season of the year and the parallax of the moon. During November, December, January, and February, on the periodical ebb of the sea, when the current sets down the bay, the tidal rise is small and the streams weak, and consequently, there are no bores, except very rarely, only three instances being known in a period of twenty-two years.

During the North-east monsoon, if the wind which blows the water down the bay is unusually moderate, and the moon's parallax is high, there may be a high tide, and with it a bore, and this, in consequence of the rule of inequality of height with regard to the monsoon, will happen at night.

Bores occurring during the night, being very rare, and consequently unexpected, are particularly dangerous, but they may be guarded against by always considering their occurrence possible during the North-east monsoon at night, upon a high parallax of the moon.

With the South-west monsoon the current sets up the bay, the sea level rises, the tidal rise is high and the tidal streams strong, and whenever the parallax of the moon is high at springs there will be bores; when there are also strong southerly winds, and freshets withheld, the height of the bores is increased.

The first appearance of the bore is on the Diamond sand, on the right bank of the river below Diamond harbour, where the ascending wave runs on as a breaking roller, but it is not of much consequence until it enters the contracted reaches above Húgli point, when, besides swamping boats, it affects vessels at anchor, by causing them to run up-stream, especially if there is a strong southerly breeze.

The bore reaches a maximum at Chinsura, about 26 miles above Kidderpur, and disappears above Naya Serai, 14 miles further up the river. The bore on the 30th March, 1896, had a height of nearly 4 feet at Budge Budge and Calcutta, increasing to 5⅓ feet at Chinsura, and falling to about 18 inches at Naya Serai.

Vessels at moorings surge and roll during the passage of the bore, as there is a sudden lift of 4 to 6 feet; and when bores are expected, springs must be put on the flood moorings close down to the buoys, to relieve the jerk on the cables and bitts when the bore comes up.

It is fortunate that the bores at night, during the South-west monsoon are not so high as those in the day.

Charts 814, The Sandheads; 136, River Húgli.

EASTERN or SAGAR CHANNEL, the main ship entrance, lies between Sagar sand and Eastern Sea reef, and extends from Eastern channel light-vessel to Lower Gaspar light-vessel, or about N. by W. 26 miles. The deepest water is on its eastern side near the edge of Sagar sand, where the bottom is generally a soft but sticky clay, in which the lead sinks deeply.

INTERMEDIATE LIGHT-VESSEL (*Lat. 21° 14′ N., Long. 88° 12′ E.*), painted red, with *Intermediate* on the sides in white letters, and one mast, surmounted by a half ball, flat side uppermost, is moored N. ⅛ W. distant 14 miles from Eastern channel light-vessel in a depth of 7 fathoms.

The vessel exhibits, at an elevation of 44 feet above the level of the sea, a *white fixed* light, which should be visible in clear weather from a distance of 12 miles.

LOWER GASPAR LIGHT-VESSEL, painted red with *Lower Gaspar* on her sides in white letters, has one mast, with a black cone at the masthead, and is moored in Gaspar channel in 27 feet

Chart 814, The Sandheads. Var. 1° 0′ E.

water, distant 14 miles north-north-westward from Intermediate light-vessel.

The vessel exhibits, at an elevation of 44 feet above the level of the sea, a *white group flashing* light, with a period of system of *one minute*, showing thus:—flash, *ten seconds;* eclipse, *ten seconds;* flash, *ten seconds;* eclipse, *thirty seconds,* which should be seen from a distance of 12 miles in clear weather.

From sunset to sunrise a blue light is burnt at the half hour.

The vessel is slightly altered in position as the channel shifts.

Fog signal.—During thick or foggy weather a gun is fired and a bell sounded from this light-vessel at the hour and half hour.

Chart 136, River Húgli.

GASPAR CHANNEL (*Lat. 21° 29′ N., Long. 88° 5′ E.*), the continuation of the main ship channel into the Húgli, extends north-westward from the upper part of Eastern channel to the lower part of Sagar roads, or between Lower Gaspar and Middleton light-vessels, a distance of 12¾ miles.

The present course through Gaspar channel is slightly eastward of a line joining Gaspar light-vessels, and then passes about a mile eastward of Middleton light-vessel, the least water being about 14 feet on Middleton bar, which joins Middleton flat with Lower Long sand, but the depth varies. The water shoals gradually from 28 feet abreast Lower Gaspar light-vessel to Middleton bar.

During the South-west monsoon there is usually too much sea in Gaspar channel for a sailing vessel to work, so that unless the wind allows a vessel to head about N.N.W. ½ W. freely, with an allowance for the tidal stream, Gaspar channel should not be taken.

Tides and tidal streams.—It is high water, full and change, at Lower Gaspar light-vessel at 10h. 13m.; springs rise 15½ feet, neaps rise 12 feet above lowest low water at extraordinary springs; neaps range 6½ feet. Both flood and ebb streams set across the channel, especially in the last quarter of each tide.

UPPER GASPAR LIGHT-VESSEL, painted red, with *Upper Gaspar* in white letters on the sides, has three masts, with a black drum at the masthead, and is moored in Gaspar channel in 20 feet of water, 8 miles from Sagar lighthouse. The vessel exhibits, at an elevation of 44 feet above the level of the sea, a *white fixed* light, which should be visible in clear weather from a distance of 12 miles.

General charts 814, 829, 70.

Chart 136, River Húgli. Var. 1° 0' E.

Fog signal.—During thick or foggy weather a gun is fired and a bell sounded from this light-vessel at every first and third quarter of the hour.

Tides.—It is high water, full and change, at Upper Gaspar light vessel at 10h. 20m.; springs rise $15\frac{3}{4}$ feet, neaps $12\frac{1}{2}$ feet above lowest low water of extraordinary springs; neaps range $6\frac{1}{2}$ feet.

MIDDLETON LIGHT-VESSEL, painted red, with no masts, is moored in about 18 feet water at $2\frac{8}{10}$ miles southward of Sagar lighthouse.

The vessel exhibits, at 30 feet above the water, a *white occulting* light with a period of system of *eighteen seconds*, showing light *ten seconds*, followed by an eclipse of *eight seconds* duration; it should be visible in clear weather from a distance of 10 miles, but being unwatched, it is unreliable.

Fog signal.—A fog bell is sounded by the vessel's motion.

SAGAR ROADS (*Lat. 21° 38' N., Long. 88° 0' E.*), northward of Middleton light-vessel, and off the south-western point of Sagar island, affords safe anchorage in 5 to 8 fathoms in ordinary weather, but in heavy gales a considerable swell rolls in at high water.

Tides* and tidal streams.—It is full water and change, in Sagar road at 10h. 4m.; springs rise $15\frac{3}{4}$ feet, neaps $12\frac{1}{4}$ feet, above lowest low water at extraordinary springs. The tidal streams run fairly up and down Sagar road.

SAGAR ISLAND, of low alluvial soil, and covered with impenetrable jungle, except some clearances on its northern side, is intersected with numerous creeks or khals, and infested with wild animals. On the eastern and northern sides of the island are some large villages, where the land is cleared and cultivated; also government salt works, and in 1901 the population of the island was 42,330. No attempt should be made by a shipwrecked crew to cross the island to the lighthouse, but follow the coast round and cross the creeks in preference.

SAGAR LIGHTHOUSE, 80 feet in height, cylindrical, and painted red and white in bands, is situated about 4 cables north-eastward of Middleton point, the south-western point of Sagar island, and exhibits at an elevation of 74 feet above high water a *white flashing* light with a period of system of *three seconds*, the duration of the flash being *half a second*. It should be visible, in clear weather, from a distance of 15 miles.

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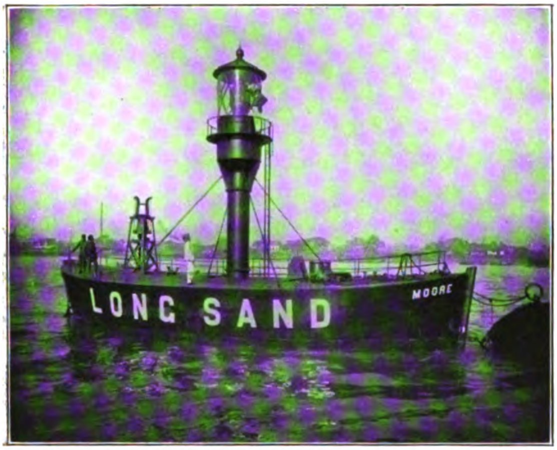
* *See* Tide Tables for the River Hoogbly (Húgli), published by authority of the Secretary of State for India.

General charts 814, 829, 70.

To face page 300.]



Long Sand light-vessel.

Chart 136, River Húgli. Var. 1° 0′ E.

Signal station (*Lat. 21° 38′ N., Long. 88° 2′ E.*).—A signal station, belonging to the Indian telegraph department is maintained at Sagar, near the lighthouse, and is connected with Calcutta by telegraph.

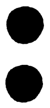
The following signal may be hoisted at Sagar island during rough weather at the Sandheads:—

T.J.P.—Pilot cannot get off.

Storm signals are hoisted at the following flagstaves:—near the lighthouse on Sagar island, near the telegraph office at Mud point, and near the telegraph office, Diamond harbour; also in the port of Calcutta—at the flagstaff upon the port commissioners' office; on a flagstaff at Shalimar point, Sibpur, and on a flagstaff at Budge-Budge telegraph office—on receipt of instructions telegraphed by the meteorological reporter to the Bengal government. These signals are distinct from those mentioned in Chapter I., pages 74-76.

A severe cyclonic storm is frequently accompanied by a storm wave, which is not often the case with a small cyclonic storm.

Day signal, No. 0, precautionary.



Two balls placed vertically. This signal indicates the existence of disturbed weather in the northern part of the Bay of Bengal. The disturbed conditions may consist of squally weather with strong winds to the south, which may shortly pass away, or which may be the first stage of a cyclonic storm, in which case the signal will be replaced by one of the following:—

Day signal, No. 1, preparatory.

A ball indicates the existence of a cyclonic storm of undetermined intensity and magnitude in the Bay of Bengal, which will certainly either cross the coast southward of a line between Chittagong and False point, or approach the Bengal coast, but which is as yet too distant to enable its track to be determined.

Day signal, No. 2, danger.

A cone indicates the early probable passage northwards, to the eastward of Sagar island and westward of Chittagong, of the vortex of a cyclonic storm of great intensity and magnitude. No sailing vessels, nor deep-laden, nor slow steaming steam-vessels should go to sea. The wind at the mouth of the Húgli will probably shift from north-east to north, north-west, &c.

Day signal, No. 3, danger.

An inverted cone indicates the early probable passage northwards, to the westward of Sagar island and northward of False point, of the vortex of a cyclonic storm of great intensity and magnitude. No vessels should go to sea, and pilots of outward bound vessels should be guided

General charts 829, 70.

by the appearance of the weather and the height of the barometer in deciding whether to proceed below Diamond harbour or Mud point. The wind at the mouth of the Húgli will probably veer from north-east, to east, south-east, &c.

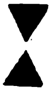
Day signal, No. 4, great danger.

A drum indicates the approach of a cyclonic storm of great intensity and magnitude to the mouth of the Húgli, and which will probably advance to Calcutta. No vessels should go to sea from Sagar island, or proceed down from Diamond harbour, and all vessels should be properly secured.

The masters of vessels in port should take the special precautions for safety laid down in the port rules.

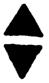
There will probably be a storm wave, but its height and destructive effect depend quite as much on the state and character of the tide when the cyclonic centre reaches the coast, as upon the depression at the centre, or the intensity and extent of the storm.

Day signal, No. 5, bad weather.



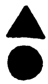
Two cones, the upper one inverted, indicate the existence of a cyclonic storm of small extent in the Bay of Bengal, which will probably reach and cross the shore of the bay southward of a line joining Chittagong and False point.

Day signal, No. 6, warning.



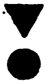
Two cones, the lower one inverted, indicate the existence of a cyclonic storm of small extent, which will probably reach and cross the shore of the bay, northward of a line joining Chittagong and False point, but the path of the vortex cannot be determined.

Day signal, No. 7, warning.



A ball below a cone indicates the probable passage northwards, to the eastward of Sagar island and westward of Chittagong, of a cyclonic storm of small extent and intensity, of the kind which usually forms in the rainy season. Vessels may proceed to sea if barometer, state of sea, and weather are such as to lead masters and pilots to infer that there is no danger. The wind at the mouth of the Húgli will probably shift from north-east to north, north-west, &c.

Day signal, No. 8, warning.

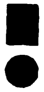


A ball below an inverted cone indicates the probable passage northwards, to the westward of Sagar island and northward of False point, of a cyclonic storm of small extent and intensity, of the kind which usually forms in the rainy season. The wind at the mouth of the Húgli will probably veer from north-east to east, south-east, &c.

Chart 136, River Húgli. Var. 1° 0′ E.

These easterly winds produce a heavy swell and strong westerly set in the channel at the Sandheads; none but fast steamers in light trim should put to sea, and those only if the weather appearances and state of the sea, &c., permit.

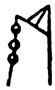
Day signal, No. 9, danger.



A ball below a drum indicates the approach towards Sagar road of a cyclonic vortex of small extent, of the kind which forms during the rainy season. It is advisable that no vessels except fast steamers in light trim should put to sea, until the direction and force of the wind, the state of the weather and sea, and the rise of the barometer indicate that the storm has either broken up or passed inland. Cyclonic storms of small extent sometimes blow with extreme force and raise a high sea near their centres.

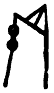
At night.—The following signals are exhibited at the signal stations previously mentioned between sunset and sunrise:—

Night signal, No. 1, warning or caution



Three lights placed vertically indicate the existence of a cyclonic storm in the northern part of the Bay of Bengal.

Night signal, No. 2, danger.



Two lights placed vertically indicate the early approach of a cyclonic storm to the Bengal coast, or to the port of Calcutta if the signal is exhibited there.

Kalpi anchorage.—Compass adjustment marks.—A mast, the lower part of which is painted in red and white bands, surmounted by an oval-shaped cage, erected on the right bank of the river at Kalpi road 30 miles above Sagar road, in line with Jigerkolli obelisk, bears N. 79° 41′ W. (true), and is intended as a mark to enable vessels to ascertain the error of the compass.

There is good anchorage with this mark on, and Kantabaria obelisk bearing N. ½ E.

Lights (*Lat. 22° 6′ N., Long. 88° 11′ E.*).—A *white fixed* light is exhibited at an elevation of 12 feet above the river, from a position near Kalpi beacon and should be visible, in clear weather, from a distance of 5 miles.

A *red fixed* light is shown at an elevation of 16 feet above the river from an obelisk or mast on Kantabaria point, about 3 miles northward of Kalpi, and should be visible, in clear weather, from a distance of 5 miles.

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Chart 136, River Húgli. Var. 1° 0′ E.

DIAMOND HARBOUR, in Húgli river above a creek of the same name on its left bank, and about 42 miles above Sagar road, affords anchorage for large vessels, but is seldom resorted to except by foreign vessels not wishing to ascend to Calcutta.

This is the third reporting station for passing vessels, who are boarded by a dak boat, generally furnished with the latest weather chart, railway time-table, &c.; the boat for outward-bound vessels flies a blue flag, and that for inward-bound vessels a red flag.

Lights.—A *red fixed* light is exhibited, at an elevation of 14 feet above the river, from a yardarm at the telegraph office; and a similar light is shown from near the Custom house: these lights, in clear weather, should be visible from a distance of 2 miles. A similar light is also shown at Fisherman's point, on the west bank of the river.

Communication.—Diamond harbour is connected with Calcutta by railway and road, and there is a telegraph station and Custom-house.

Tides.*—It is high water, full and change, in Diamond harbour at 11h. 55m.; springs rise 16½ feet, and neaps 12¼ feet, above lowest low water at extraordinary springs; neaps range 7¼ feet. These tides are computed for the dry season only; during the freshets, spring tides probably rise 3 to 4 feet higher.

CALCUTTA, the capital of the Indian Empire and the official residence of the Viceroy and Governor-General, is situated on the left bank of the Húgli, about 86 miles from its mouth, originally the site of the three riverside hamlets of Sutanuti, Kalikata, and Gobindpur; it stretches northward for 6 miles along the river bank, is only from 18 to 21 feet above mean sea level, and covers an area of 20,547 acres.

Port (*Lat. 22° 35′ N., Long. 88° 22′ E.*).—The port of Calcutta extends for nearly 16 miles along the Húgli, or from Budge-Budge khal or creek on the south to Cossipur on the north, the limits being marked by pillars, and moorings are laid down for about 43 large vessels, which can also be accommodated in the wet docks or at the jetties, which are suitable for vessels of 28 feet draught, but by using pontoons a very large number of berths for that draught could be obtained; both docks and jetties are furnished with hydraulic cranes, and are connected with the several railways.

There is sufficient water for vessels, of any draught that can enter the river, at the moorings, where they are required to moor head and stern with two bower and two stern cables, shackled to the permanent moorings laid down parallel to the bank.

The port rules are supplied to vessels on arrival.

The navigable channels of the Húgli, leading to the port of

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* *See* Tide Tables for the River Hooghly (Húgli).

Calcutta from a line drawn East and West from Eastern channel light-vessel, are subject to the jurisdiction of the commissioners for the port of Calcutta.

Calcutta reach (*Lat. 22° 35′ N., Long. 88° 22′ E.*) extends from Kidderpur docks to Húgli bridge on the east, and from Shalimar point to Howrah docks on the west bank of the river, trending from about S. by W. ½ W. at the bridge to W.S.W. at Kidderpur, a distance of $2\frac{6}{10}$ miles. The channel lies close along the Calcutta bank and contracts in width from 2½ cables at the bridge to 1¼ cables abreast Fort point; it then widens to 3 cables abreast Kidderpur. There are from 36 to 51 feet in the channel for about 7 cables below the bridge, and then 23 to 60 feet to Garden reach.

Navigation.—Vessels going against the tidal stream should ease down or stop if likely to meet other vessels at difficult parts of the river, or on bars where the deep water channels are narrow. The usual rule of the road is adhered to in the river and estuary. A prolonged blast of the steam whistle, quickly followed by three short blasts, is an optional signal that the vessel making the signal is obliged to stop, and cannot get out of the way.

Tugs.—Several tugs are available.

Tides.*—It is high water, full and change, at Calcutta at 2h. 2m.; springs rise 17 feet; neaps rise 12 feet, above Kidderpur old dock sill, which is 7·986 feet below mean sea level, and has been accepted as equivalent to the level of mean low water ordinary springs; neaps range 7 feet. During the freshets mean springs rise 21 feet, and mean neaps 16 feet, above Kidderpur old dock sill, and between December and June, the dry months, the average rise at springs is 15 feet 2 inches, and at neaps 11 feet 4 inches, above the same datum.

The time of high water is that at which the tide reaches its greatest altitude and commences to fall, although the stream will continue to run up about an hour, and the time of low water is that at which it reaches its greatest depression and commences to rise, although the stream will continue to run down a little more than an hour.

Tidal streams.—When regular, the flood stream runs 5 hours, the ebb stream 7 hours. During the North-east monsoon the rate of the streams is 3 to 3½ knots at springs, and 1½ to 2 knots at neaps; between March and July the rate of the flood stream is 4 to 6 knots at springs; and during the freshets, July to October, the rate of the streams is sometimes 6 knots; anchors are then quickly buried by the silt, so that sometimes it is necessary to slip the cable and leave the anchor to be picked up by the Port Commissioners' hoy. The tidal streams set fair up and down the reach.

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* *See* Tide Tables for the River Hooghly (Húgli).

Chart 136, River Húgli. Var. 1° 0′ E.

CITY (*Lat. 22° 35′ N., Long. 88° 22′ E.*).—In the centre of the city stands Fort William, surrounded by an expanse of park, known as the Maidan, and northward of this are the shops and business houses of the Europeans, whose residential quarter bounds it on the east.

Among the public buildings may be mentioned the Government house; Belvedere, the residence of the Lieutenant Governor, and the High Court; the Town Hall, the Indian Museum, the Mint, and the General Post Office, while the churches are the Cathedral church, St. John's, the old Catholic, and the Roman Catholic cathedral.

The European suburbs of Ballygunge and Alipore, which latter contains the residence of the Lieutenant General of Bengal, lie to the southward and south-eastward, and the European quarter is surrounded on all sides by the native town, the lanes of which are narrow, tortuous, and badly lit, with overcrowded and insanitary dwellings, but three main roads traverse it from north to south and five or six from east to west.

Population.—In 1901 the population of the city was 847,796.

Communication.—The British India Company have weekly steamers to Rangoon, Penang, Singapore, Chittagong, Akyab, Kyaukpya, Sandoway, and Moulmein, and those of the Messageries Maritimes to Madras, Pondicherri, and Colombo, and coasting trade is carried on by vessels of the India General, Calcutta Steam and Rivers Steam Navigating Companies.

Three great railways converge on Calcutta, the East Indian connecting it with Bombay, the United Provinces, and the Punjab: its terminus is on the west bank of the river at Howrah, but a branch, crossing the Húgli by a bridge at Naihati, 25 miles up the river, provides access to the docks at Kidderpur over the Eastern Bengal State railway.

The Bengal-Nagpur railway runs through Orissa to Madras, and westward through the Central Provinces to Bombay; its terminus is also at Howrah, but a wagon ferry plies between Shalimar and the docks.

The Eastern Bengal State railway, the terminus of which is at Sealdah, connects Calcutta with North and East Bengal and Assam, and with Diamond harbour.

There are two light railways from Howrah to Amta and Sheakhala, and lines of electric tramways run in the principal parts of the city. Calcutta has telegraphic communication with all parts.

Húgli bridge, crossing the river above Howrah railway terminus, is a wooden structure about 1,530 feet long, floating on iron pontoons, and is opened for the passage of vessels three times a week, as advertised in the daily papers. There are also several ferries.

Coal and supplies.—Almost any quantity of coal can be obtained, as nearly one million tons are raised from the mines annually, and about 1,000 tons could be put on board in twenty-four hours, vessels coaling either at Budge Budge in the stream or at the docks, where the coaling space is practically unlimited. About 100 tons of liquid fuel is kept in stock, and about 500 tons imported annually; it could be put on board as quickly as a vessel could take it.

Fresh provisions and stores are plentiful and cheap, and filtered water is supplied to shipping, either by boats or from hydrants, on making application to the Superintendent of Water Supply for Shipping at the police office.

Repairs.—Large repairs to machinery can be executed, and there are a number of cranes, one of which will lift 30 tons.

Docks (*Lat. 22° 35′ N., Long. 88° 22′ E.*).—The Government have one dock and the Port Commissioners have two, and there are seven private docks, also four patent slips. For dimensions, *see* Appendix, page 565.

Hospital.—There is a hospital for seamen and a sailor's home at Calcutta. Ambulance cars with bearers are stationed at suitable places for the conveyance of seamen to hospital.

Time signals.—At Fort William semaphore tower, at an elevation of 128 feet above the river, a ball, hoisted close up at five minutes before the signal, is dropped daily at 1h. 0m. 0s. p.m., Calcutta mean time, equivalent to 19h. 6m. 39·2s., Greenwich mean time.

A ball, also hoisted up at 5 minutes before the signal, is simultaneously dropped at the Port Commissioners' office, about 1¼ miles higher up, and 116 feet above the river.

At Kidderpur docks, at an elevation of 84 feet above the river, a ball is hoisted 5 minutes before the signal is dropped at the same time as the preceding.

A flag is hoisted on the semaphore tower at the Port Commissioners' office at 20 minutes before the signal.

Indian mean time is only kept by railway, postal, and telegraph services, otherwise mean time of place is that generally used.

Trade.—The chief exports are raw and manufactured jute, tea, opium, hides and skins, oilseeds, grain and pulses, indigo, lac, raw cotton, coal, raw silk, saltpetre, and oils; and imports, cotton goods, treasure, metals, oils, sugar, machinery, woollen goods, hardware, salt, liquors, apparel, drugs, &c. In the years 1909-10 the former were valued at 70,10,04 lakhs, and the latter at 52,06,73 lakhs; the amount of coal exported was 3,726,941 tons.

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Chart 136, River Húgli. Var. 1° 0′ W.

In the same years the port was entered by 531 steam and 8 sailing vessels, with aggregate tonnages of 1,548,069 and 1,048 tons.

Climate.—The climate is hot and moist, the average mean temperature being 77·9°; mean maximum 106·6°, in June, and mean minimum 45°, in December. The average temperature in the hot season is 85°, in the rains 83°, and in the cold season 72°. The average rainfall is 59 inches. *See* Meteorological table, Appendix, page 577.

Chart 814, The Sandheads. Var. 0° 50′ E.

THE SUNDARBANS are fully described in Chapter I., page 36.

The extreme length of the coastline of the Sundarbans is about 165 miles, the western and eastern portions lying high when compared with the low and swampy central part, towards which the ground gradually slopes.

In the western part, the water of the streams is usually salt, and the cultivated lands are surrounded by high embankments with scattered clusters of huts. In the central part there are no habitations, the water is fresh, and the embankments surrounding the fields are lower.

In the eastern part, the land is high, the soil is richer, and, as the river water in this part is almost fresh, embankments are not necessary; the inlying parts are to a great extent protected from the effects of cyclonic storm waves by the belt of thick jungle near the sea.

The chief place in the Sundarbans is Khulna, about 65 miles eastward of Calcutta, at the junction of Atharabanka and Bhairab rivers, towards which boats can be tracked through the Calcutta canals. Khulna has railway communication.

Houses of refuge for shipwrecked seamen and others have been erected on the Sundarbans in the following places:—

No. 1, at Seyer point (*Lat. 21° 33′ N., Long. 88° 15′ E.*), 13 miles east-south-east of Sagar lighthouse, is painted red, and is on a grassy plain eastward of some high sand hills.

No. 2, on the eastern side of, and 3 miles within, Sattarmukhi river entrance, and 9 miles north-eastward of house No. 1, is painted white, and situated in thick jungle one cable above high-water mark.

No. 3, on the western side of Balchari island and eastern side of Jamira river entrance, is painted black, and lies one cable above high-water mark.

No. 4, on the south-east point of Dalhousie island and 6 miles eastward of Matla river entrance, is painted white, and built on a sandy patch; when last reported on a spar and bamboo with a white flag was visible over the trees close to it.

General charts 829, 70.

Owing to these houses being continually looted, they are now supplied with water only, and are visited by a steam vessel after cyclones and heavy gales, so that, under such circumstances, it would be advisable for shipwrecked persons having no boats to remain by the house, until assistance arrives, or, if travelling, the party should keep together, as the jungle is infested with tigers.

Each house is supplied with a punt, with which it may be possible to communicate with vessels entering the river, and a rope, placed amongst the stores, is for the purpose of assisting to construct a raft for tracking purposes, the wood for which may sometimes be found thrown up in quantities.

When travelling, the branches of trees should be broken on the same side of the trees as the direction in which the party is proceeding, leaving the broken parts hanging, and this especially at turning points or the entrances of any creeks that may be passed, so that a search party may know the route to be followed.

Means of kindling a fire should, if possible, be taken, and the following will be found edible:—

The hearts of young palm trees and the scurvy grass or samphire, both growing in great quantity; oysters, which may be obtained at low water only from an oyster bed on the opposite bank of the river to No. 4 Refuge house; these latter are coarse flavoured, but very nutritious, and may probably be found in other localities.

Water can be procured by digging down a few feet on the higher parts of the land near No. 1 Refuge house, and shoots attached to the roofs of houses are for catching water, which is saved by a hose to be found amongst the stores; the tanks should be filled when rain occurs, and, if possible, before leaving the house.

Eastward of Sagar island are a series of low alluvial jungle-grown islands, intersected by numerous creeks and rivers, and with sands extending many miles southward of them, for which the chart is the best guide.

Lacams channel (*Lat. 21° 15′ N., Long. 88° 24′ E.*), leading to Baratola river or Channel creek, which passes eastward of Sagar island, is the entrance to the Húgli between Sagar and Sattarmukhi or Lighthouse sands. Lacams channel appears to have a fairway about 2 miles to half a mile in width into Baratola river, or Channel creek, but the latter cannot now be used by sea-going vessels, as very rapid changes have been going on of late years in this part of the Sundarbans.

Sattarmukhi channel, the entrance to which is between Sattarmukhi and Balchari sands, splits into two branches abreast

Chart 814, The Sandheads. Var. 0° 50′ E.

Balchari island, the western being Sattarmukhi river, and the eastern Jamira river, neither of which are visited by sea-going vessels.

Tides.—It is high water, full and change in Sattarmukhi channel 9h. 30m.; springs rise 12 feet. The tidal streams have a velocity of about 2 knots.

MATLA LIGHT-VESSEL (*Lat. 20°57′ N., Long. 88°34′ E.*), painted red, with *Matla* in white letters on the sides, has three masts, and a black half ball, flat side upwards, surmounted by a cone, point downwards on the main; it is moored, in 17 fathoms water, off the entrance to Matla river, and exhibits, at an elevation of 48 feet above water, a *white group flashing* light, with a period of system of *thirty seconds*, showing two flashes each of about *two and a half seconds'* duration in quick succession, and should be visible in clear weather from a distance of 12 miles.

Buoy.—The station buoy, painted red and white in vertical stripes, and surmounted by a red open basket, is moored one mile northward of the light-vessel.

Chart 82, Matla river.

MATLA RIVER is the united Bidyadhari, Karatoya, and Atharabanka streams, and flows southward through the Sundarbans into the Bay of Bengal. The mouth of the Matla, about 27 miles eastward of Sagar island, is separated from Jamira river by Balchari island and flats. The Matla has several branches at its mouth, one of which extends to the salt-water lake near Calcutta, and is entered by two channels, the Western and the Eastern.

NOTE.—The shoals at the entrance of the river are liable to change, and the following information must be used with caution. There are no pilots for Matla river.

PORT CANNING, about 60 miles from the mouth of the Matla, and formerly a municipality, was started by an English company to supply an auxiliary harbour to Calcutta, but the attempt failed.

Communication.—A railway connects it with Calcutta, but it is chiefly used for a small traffic in timber and other produce from the Sundarbans.

Western (Ward's) channel.—Between Balchari sand to the westward, and Raimatla sand, to the eastward, is the entrance to Western channel, which is about 5½ miles in width at its entrance, narrowing to about 1¾ miles at the northern end of Raimatla sand: it is to be preferred to the Eastern channel.

Depth.—Western channel has a least depth of about 4 fathoms westward of the northern prong of Raimatla sand.

General charts 829, 70.

Chart 82, Matla river. Var. 0° 50′ E.

Eastern (Raimatla) channel (*Lat. 21° 20′ N., Long. 88° 47′ E.*), between Raimatla and Dalhousie sands, is about 2¾ miles in width at its entrance, but contracted to about one mile by a shoal extending southward of Dalhousie point, between the 5-fathoms contour lines.

Depth.—The depth is about 5½ fathoms at the entrance, with some spots of 5 fathoms in the channel of the river.

Anchorage.—The anchorage off Port Canning is in depths of from 4 to 8 fathoms.

Navigation.—The entrance to Matla river is not so difficult as that to the Húgli, and the chief difficulty to the navigation of the former consists in the fact that the soundings are so regular between Matla light-vessel and Dalhousie point that the lead gives no indication as to the position of a vessel as regards the edges of the sands either side, and these, both in the channels and in the river, are so steep as to render borrowing on them dangerous.

Raimatla sand extends from its southern extreme in a north-northwest direction for nearly 17 miles with a width of from 3 to 4 miles; a narrow spit then projects about 6 miles further northward to about 2½ miles south-westward of Dalhousie point. A portion of the sand about 3 miles in length by 2 miles in width about 12 miles from its southern extreme, dries in places at low water.

Dalhousie point has clumps of trees on it, the westernmost appearing double and larger than the rest; this point and Halliday island, to the westward of Dalhousie island, may be seen from a distance of about 10 miles when at a height of about 24 feet. On nearing Dalhousie point it shows a high white sandy beach, conspicuous when the sun is out.

Below Kattalí, which is situated 12 miles northward of the north point of Dalhousie island, the land is so low that at high water springs the water runs some distance inland, and from the sea to Edu reach there is dense jungle, but from that reach to Canning, a distance of about 8 miles, there are clearances with native villages.

Tides.—It is high water, full and change, at the following points near the entrance and in the river:—

At Matla light-vessel at 9h. 43m.; springs rise 9¼ feet, neaps rise 6⅔ feet, neaps range 3⅓ feet.

At Western channel at 9h. 0m.; springs rise 10 feet.

At Halliday island at 10h. 12m.; springs rise 10 feet, neaps rise 7½ feet, neaps range 5 feet.

At Kattalí, on the west side of the entrance to Bidda river, at 10h. 45m.; springs rise 14 feet, neaps rise 12 feet, neaps range 7 feet.

General charts 829, 70.

Chart 82, Matla river. Var. 0° 50′ E.

At Port Canning at 0h. 5m.; springs rise 17½ feet, the tidal rise being above lowest low water at extraordinary springs.

Tidal streams.—The tidal streams below Dalhousie sand appear to rotate, the flood stream setting west-north-westward at its commencement and working through north, round to east-north-east, and the ebb stream setting east-south-eastward through south to west-south-west, at rates of 2 to 3 knots at springs and one knot to 1½ knots at neaps.

In the channel the flood stream tends towards the eastern shore until abreast Dalhousie river at the north end of Dalhousie island, when it crosses southward of Grappler sand towards Peel point, forming eddies; it then runs northward to Roger point, where it bifurcates, the greater portion going up Bidda river, and the rest round Roger point into Kattalí bight, leaving slack water in the vicinity of Bidda river point.

The rate of the flood stream varies in different parts of the river, but 5 knots an hour is the greatest recorded.

The ebb stream sets fairly down the river, but it forms considerable eddies off Roger point; at the last of the ebb the stream sets from abreast the north end of Dalhousie island across the river towards Halliday island. The greatest recorded rate of the ebb is from one knot to 2½ knots.

Canning town is almost deserted and in a dilapidated condition; the brick buildings, exclusive of railway station, cutchery, and rice mills, being in ruins; in 1901 the population was 1,049.

Chart 859, Matla river to Elephant point.

BANGADUNI RIVER, about 5 miles eastward of Matla river, is small, and about 3 miles in width at its entrance between Dalhousie and Bangaduni sands. Bangaduni island is on the eastern side of the entrance, and northward of it is a narrow channel in which the depths are from 2¾ to 8 fathoms.

Depths.—There is a depth of 5½ fathoms in mid-channel of the entrance, shoaling to 3¾ fathoms about 5 miles inside, and with a bar on which there is a least depth of half a fathom connecting the northern part of Dalhousie sand with the south-west point of Bangaduni island.

Guasuba river, about 5 miles eastward of Bangaduni river, is of considerable size, but difficult to enter on account of the shoals at its mouth, which are probably subject to change.

Raimangal river (*Lat. 21° 23′ N., Long. 89° 15′ E.*), about 12 miles eastward of Guasuba river, receives, at 6 miles from the sea, Hariabhanga stream on its western, and the Jamuna on its eastern

General charts 829, 70.

side. This river is one of the most considerable openings on the coast, but it requires local knowledge for its navigation; the outer part is about 1½ miles in width.

Depths.—Raimangal river has a depth of 3½ fathoms at its entrance, and appears to have depths of from 4 to 7 fathoms to its bifurcation, and even deeper water inside that.

Malancha river entrance is about 7 miles eastward of Raimangal river, and is less than half a mile wide in places.

Depths.—The channel leading into it from the southward has depths of 3 to 4 fathoms, and is narrow, with deeper water within.

Bara Panga river, entered about 5 miles eastward of Malancha river, is divided from it by Putni island, from which island flats, with 3 fathoms and less water over them, extend southward and south-eastward for about 11 miles.

Depths.—There does not appear to be a depth of more than 2 fathoms at the entrance to this river.

Marjata (Kaga) river entrance is about 9 miles eastward of Putni island, and appears to have extensive banks in it; two low islets, named Pavanga, are about 5 miles inside the entrance.

Depths.—There appears to be a depth of about 3¼ fathoms in the channel, which is intricate.

Bangara river entrance is about 13 miles eastward of that of the Marjata; the river is small and takes a south-easterly course near its mouth, which is separated from that of Marjata by two islands with a small river between them. All three rivers communicate with each other.

Argo flat is the extensive shoal which extends off the mouths of Bangara and Haringháta rivers and stretches seaward for about 15 miles. The flat has general depths of from 1¼ to 2¾ fathoms over it, but shows dry sandbanks in places, and heavy breakers have been observed on it at a distance of about 10 miles southward of Tiger point, on the western side of Haringháta river entrance.

Swatch of No Ground (*Lat. 21° 24′ N., Long. 89° 34′ E.*), a remarkable depression in the coast bank of soundings, is from 6 to 12 miles in breadth; from the position given, which is its north end, it drops suddenly to 90 and 113 fathoms, whence it extends seaward in a south-south-west direction, and at a distance of about 46 miles there is a depth of 595 fathoms.

HARINGHÁTA (BALESWAR) RIVER, signifying Deer ford, about 12 miles eastward of Bangara river entrance, is a deep estuary about 7 miles broad at its mouth, which is the outlet of one of the principal distributaries of the Ganges, the river and its tributaries passing through a tract of fertile country.

Navigation.—The river is navigable by sea-going ships as high as Morrellganj, 33 miles from the entrance, and throughout its entire course by the largest native boats, and the navigation is said to be easier than that of any other river at the head of the Bay of Bengal, as the river is free from a bore, and also from mid-channel dangers.

A heavy sea prevails at the entrance during the South-west monsoon, and it should not be entered without local knowledge, failing which a pilot is always necessary.

Depth.—The bar which stretches across the mouth of the Haringháta has about 2½ fathoms over it at low water.

Morrellganj was converted from impenetrable jungle into a prosperous rice-growing tract, and here the river, which is tidal, is about a quarter of a mile broad, with deep water from bank to bank, affording sheltered anchorage, with good holding ground; although its position on a navigable river, commanding a rich rice country, renders it a great centre for local trade, it has never yet become a port for sea-going vessels. In 1901 the population was 972.

Communication.—Morrellganj is an important place of call for steamers of the Cachar-Sundarbans service.

Tides.—It is high water, full and change, at Haringháta river entrance at 11h. 0m., springs rise 10½ feet.

Tidal streams.—The rate of the tidal stream is reported to exceed 4 knots at springs.

Rabnabad islands are situated on the eastern side of the entrance to the channel of the same name, and about 18 miles eastward of Haringháta river, the westernmost and largest island is nearly 14 miles in length and 2½ miles in greatest breadth. Rabnabad channel, westward of it, is narrow, with a depth in the northern part at low water of 2¼ fathoms. After turning round the northern point of Rabnabad island, this channel connects with Ganges river through Kajul and Tetulia rivers, which are little known.

Barisál town (*Lat. 22° 42′ N., Long. 90° 21′ E.*), on the west bank of Barisál river (which is connected with the Ganges), is the headquarters of Backergunge district, and has wide, straight, and well-kept streets, the riverside road to Sagardi being bordered by fine avenues; it is intersected by numerous creeks, which are flushed twice daily at flood tide, thus adding greatly to the health of the town.

Chart 859, Matla river to Elephant point. Var. 0° 50′ E.

In addition to the usual public offices it has three churches belonging to the Anglican, Roman Catholic, and Baptist persuasions, a college, and free library; in 1901 the population was 18,978.

Communication.—The Barisál river is navigable by steam vessels all the year round, and daily steamers ply to Khulna and Narayanganj, establishing communication with Calcutta and Dacca, the journeys occupying 24 and 12 hours respectively; there is also steamer communication with Patuakhali.

Tetulia river (*Lat. 22° 17′ N., Long. 90° 38′ E.*), which appears to afford the nearest route to Barisál from seaward, is from 2 to 3 miles in width, but has not been surveyed.

MEGHNA FLATS extend several miles south-eastward of Haringháta river mouth, and south-westward of the Shahbazpur entrance to Meghna river, the position given being that of their southern extreme, and apparently they are not extending.

D'Apres shoal, a sandbank which dries at low water, is situated about 60 miles north-eastward of the south extreme of Meghna flats, or about 24 miles southward of the south point of Hatia island on the eastern side of the entrance to Shahbazpur river.

A shoal, on which a depth of 15 feet is reported, lies nearly 15 miles eastward of D'Apres shoal, and the area to the northward of these shoals has not been surveyed.

Tides and tidal streams.—It is high water, full and change, off the south extreme of the Meghna flats at 9h. 30m.; springs rise 10½ feet. In depths of 5 fathoms and less there is always a swell during the first half-hour of the flood stream.

Near D'Apres shoal, it is high water, full and change, at 1h. 30m.; springs rise 9 to 10 feet; the rate of the tidal stream is about 4 knots.

BRAHMAPUTRA RIVER, known to the Assamese as the Haraniya, has an estimated length of about 1,800 miles; the great bulk of its waters flow south-westward, and reach the sea by the broad estuary of the Meghna river. The actual course before reaching British territory has not been satisfactorily determined, but the main stream of the river is formed by the confluence of the Dibang, Dihang, and Brahmaputra proper, in about lat. 27° 50′ N., long. 95° 50′ E.

In agricultural and commercial utility the Brahmaputra ranks next after the Ganges and the Indus among the rivers of India, although no large towns are situated on its banks. It is navigable by river steamers as high up as Dibrugarh, about 800 miles from the sea, but the current is so strong in places, that vessels are sometimes unable to make headway, and have to stop for days.

General charts 829, 70.

Chart 859, Matla river to Elephant point. Var. 1° 0′ E.

Sirajganj, in the Bengal district of Pabna, is the largest emporium on the banks of the Brahmaputra and is where the produce of the surrounding country is collected for transmission to Calcutta. The export or down-stream trade consists chiefly of tea, timber, oil-seeds, caoutchouc, and raw cotton from Assam; and jute, oil-seeds, tobacco, rice, and grain from Eastern Bengal.

The imports up stream are European cotton goods, salt, and hardware to Sirajganj; and rice, tea, seeds, liquors, &c., for Assam. Steamers run from Calcutta to Dibrugarh all the year through, the time occupied varying from 20 to 25 days.

Sandwíp island (*Lat. 22° 29′ N., Long. 91° 25′ E.*), about 14 miles long in a north-north-west and opposite direction, about 8 miles in width, and the largest of the islands or chars at the entrance of the Meghna, is low and fertile, and said to be free from tigers and other wild beasts. The principal village is on the eastern side; the cocoanut palm flourishes, and sugar cane is cultivated to a great extent. In 1901 the population of this island was 115,127.

This island and Hatiá are particularly subject to inundation from storm waves. *See* page 318.

MEGHNA RIVER* is the outlet of the main volume of the waters of both the Ganges and Brahmaputra, the main streams of the Brahmaputra or Jamuna and Ganges or Padma uniting at Goalunda, and entering the Meghna near Chandpur. The Meghna runs southward throughout its course, dividing Eastern Bengal into two parts, and enters the sea by four principal mouths enclosing the three islands, Dakshin Shahbazpur, Hatiá, and Sandwíp.

For some years the Meghna has shown a tendency to shift its channel gradually westward, and near Noakhali the mainland is said to have advanced seaward 4 miles in 23 years.

Navigation.—The river is navigated by river steamers and native boats all the year round, but the navigation is difficult and dangerous owing to the sea set up at high water, and at low water to snags and shifting banks; the most favourable time for navigation is between November and February.

Shahbazpur river branches from the Meghna immediately above Narnak char, and flows between Dakshin Shahbazpur on the west, and Falcon char, Surloki, and Hatiá on the east.

Depths.—The entrance of this river has not been properly surveyed, but there seems to be a channel over the flats with a depth of about 15 feet at low water.

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* The name Meghna is properly applied only to the channel of the old Brahmaputra, from Bhairab bazár downwards.

General charts 829, 70.

Sandwíp channel (*Lat.* $22° 24'$ *N., Long.* $91° 38'$ *E.*), formerly the navigable entrance to Meghna river, is now closed by sandbanks.

Navigation is practicable as far as Narayanganj for steam vessels drawing 10 feet, but it is dangerous between February and November, when at spring tides a heavy bore is experienced in the lower parts of the river.

Native pilots, who are regularly employed in the coasting trade, can be obtained at Chittagong. The aid of local pilots or boatmen is necessary in this navigation.

Bars.—Owing to the continual alteration in the channels of the Meghna river, no useful directions for navigation can be given, but in March, 1902, the depths on some of the principal bars were as follows:—

Pajamassa bar, north-westward of Pajamassa char, had a depth of 9 feet, the spring rise being 11 feet.

Hatiá bar, considerod the worst between the entrance and Chandpur, and situated between Hatiá and Surloki islands, had 6 feet water in a very narrow channel, the spring rise being about 10 feet.

Lallon bar, north-westward of Lallon and Falcon chars, had a depth of 9 feet in its narrow, tortuous channel, the rise at springs being about 8 feet.

Between Chandpur and Narayanganj are several narrow, intricate, and shoal bars, those having the least depth over them being situated at 3½ miles above Chandpur and 4½ miles below Narayanganj.

Tides.—It is high water, full and change, approximately, at the following places:—

Hatiá bar, 3h. 0m.; springs rise about 10 feet.
Pajamassa bar, 2h. 10m.; springs rise about 11 feet.
Mills point, 4h. 0m.; springs rise about 7 feet.
Chandpur, 6h. 30m.; springs rise about 5½ feet.
Narayanganj, 8h. 30m.; springs rise about 3 feet.

The bore in the outer channels of the Meghna is very strong for four days at spring tides, and its influence is felt to a little beyond Ilsa river or about 50 miles below Narayanganj. Rushing with violence as a high-crested wave, the Sandwíp channel bore meets another passing up between Hatiá and Sandwíp islands, and off the north-western end of Sidí forms a dangerous whirl. Between November and February the bore is less high, and is not considered dangerous.

At the time of the equinoxes, especially with a southerly wind, the bore attains its greatest development, when it advances like a wall topped with foam estimated to be nearly 20 feet high, at the rate of

Chart 859, Matla river to Elephant point. Var. 1° 0′ E.

15 miles an hour. In a few minutes the wave has passed, and the tide has changed from ebb to flood.

The bore was observed from an anchorage at Hatiá bar, at three days after new moon, extending completely across Shahbazpur river, being from 3 to 4 feet in height on the shoal flats, but somewhat less in deep water, and only breaking occasionally; its estimated velocity was from 5 to 6 knots, and it is probable that it is comparatively slight in this river.

The storm wave, which occasionally sweeps up the Meghna river in the wake of cyclones is even more dangerous than the bore; it is also most liable to occur at the break of the monsoons in May and October, and the most disastrous on record occurred on the night of 31st October, 1876, when two or three waves came on in succession, flooding in one moment, the entire country, and destroying on the islands of Sandwíp and Hatiá and a portion of the mainland the estimated number of 100,000 persons.

Chandpur, a town situated on a creek of the same name, is rapidly rising in importance, and in 1901 had a population of about 7,000.

Communication.—Chandpur is one of the principal stations of the Indo-General S.N. Company's steam vessels, which connect with the railway systems at Goalunda and Narayanganj; it is also the terminus of the Assam-Bengal railway from Comilla.

Coal and supplies.—A supply of Bengal and Assam coal may be procured. Fresh provisions and water can be obtained.

NARAYANGANJ (*Lat. 23° 37′ N., Long. 90° 32′ E.*), on the west bank of the Lakhya, extends for about 3 miles along the river, is a place of transhipment for country produce, particularly jute, and piece goods, salt, and European wares are distributed; there are several mills and steam jute presses, the bulk of the trade being in the hands of native merchants. The population in 1901 was 24,472.

Communication.—There is daily postal and inland steam communication with Calcutta, steamers towing large flats laden with cargo. A railway runs northward to Mymensingh and Singhjani, and a steamer service connects with the railway to Calcutta at Goalunda ghát.

Storm signals are shown at Narayanganj. *See* Chapter I., pages 74-76.

CHITTAGONG DISTRICT coastline extending for a distance of about 135 miles in a south-south-east direction from the mouth of the Fenny river has ports at Chittagong and Cox's Bazar. *See* Chapter I., page 37.

General charts 829, 70.

Chart 859, Matla river to Elephant point. Var. 1° 0′ E.

COAST.—Sitakund mountain, on the mainland about 13 miles eastward of the north end of Sandwíp island, is about 3 miles inland and 1,155 feet high; a ridge of hills extends southward from it at about the same distance from the sea.

Nagarkona (*Lat. 22° 14′ N., Long. 91° 47′ E.*), 289 feet, and Fakir hill, 239 feet high, and marked by pillars, known as Goods pillars, 20 feet high and painted black, are at the southern end of the ridge and northward of Chittagong.

A white sand beach borders the shore, and at about 2¾ miles northward of Patunga point, Mabesh Kalle creek, which joins Karnaphuli river below Chittagong, enters the sea.

CHITTAGONG APPROACH.—Excepting a narrow vein of deeper water, from one mile to 3 miles in width, which extends to the northward near to the coast for a distance of about 20 miles, its northern end being about 30 miles southward of Chittagong, the approach is generally in depths of less than 10 fathoms for a distance of 50 miles.

On the western side of this approach is the shoal water, with depths under 5 fathoms, extending south-eastward of Meghna flats, and on the eastern side outlying dangers from the mainland named South patches, North patches, and Dolphin shoal (page 328); the 5-fathoms contour line is about 15 miles south-south-westward of the entrance to the river.

The tidal streams in this part of the bay set northward and southward with the trend of the land, with a rate at springs of 5 and 6 knots an hour, and in hazy weather vessels have been swept past Chittagong by the flood or north-going stream, and set upon the sands westward of Sandwíp island, without sighting either Katubdia island light by night, or the land by day.

LIGHTS.—A light-vessel marks the south-west side of South patches (page 329), and exhibits a *white fixed* light.

On the western side of Kutubdia island, at 20 miles southward of Karnaphuli river entrance, a *white group flashing* light is shown (page 327).

Plan 84, Karnaphuli river.

A small brick tower, 47 feet in height and painted white, situated 1¼ miles south of Norman point, Karnaphuli river entrance, exhibits at an elevation of 55 feet above high water, a *white occulting* light, which is eclipsed for *four seconds* with a period of system of *thirty seconds*, and should be visible from a distance of 10 miles in clear weather.

Patunga point, the northern high-water entrance point of Karnaphuli river, is low, flat, cultivated in places, with few trees, and

General charts 829, 70.

Plan 84, Karnaphuli river. Var. 1° 0′ E.

a grassy plain extends some miles inland from its blunted southern point. A sand and mud flat surrounds the point, its southern end being nearly 1½ miles south-south-westward of the point.

Beacon.—Patunga beacon, standing close to the southern edge of the point, is 78 feet in height, painted white, and surmounted by a triangle, apex upwards.

Norman point (*Lat. 22° 11′ N., Long. 91° 50′ E.*) is 1⅓ miles northward of the lighthouse, and between the coast is composed of sandhills, from 10 to 18 feet high, backed by a strip of grass and mud, which covers at extraordinary spring tides; a sandflat, about a quarter of a mile in width, fronts the sandhills.

Four-tree hill, 127 feet high, and with four trees on it, is 2 miles east-north-east from Norman point, and appears from the river to form the southern limit of an extensive tableland, of which Júldia hill forms a part.

Signal station.—A signal station and flagstaff, which is 100 feet high, are situated on Júldia hill.

Storm and tidal signals are shown. *See* storm signals, pages 74-76

Outer anchorage.—In case of necessity anchorage may be obtained anywhere off the river entrance in a depth of 5 fathoms, with good holding ground.

Chart 859, Matla river to Elephant point.

Directions.—Whatever the state of the weather or time of the year, but especially during the South-west monsoon, or from April to September, the greatest care is necessary in making Karnaphuli river.

Even with favourable weather and the position known, strict attention to the depth as well as to the course and distance made over the ground, by using the ground log, is necessary.

The light-vessel marking South patches, if reliable, should be of great assistance in approaching the river, as Kutubdia light is sometimes obscured by fog and mist, but it might be safer to make the land in the day time if possible, as the approach to the outlying dangers already mentioned, is not indicated by the soundings.

If the position is doubtful, and the ground log denotes a strong flood or north-going stream, it is well to anchor, to avoid being set on the shoals extending from Sandwíp island and Meghna river entrance, which latter may extend further southward than the chart indicates.

In the South-west monsoon, from the southward in cloudy weather and with no observations, the white cliffs at Cox's Bazar may be

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Chart 859, Matla river to Elephant point.

sighted (page 332); then pass between North and South patches, and outside Dolphin shoal, using the lead and considering the tidal streams.

CAUTION.—During the North-east monsoon it occasionally happens that small fog banks or thick mists occur on the Chittagong coast, causing the lights in some instances to appear a deep red colour, and at others entirely obscuring them.

Plan 84, Karnaphuli river. Var. 1° 0′ E.

KARNAPHULI RIVER, the most important river in Chittagong district, rises in a lofty range of hills to the north-east, and after pursuing a tortuous course, enters the district of Chittagong at Chandraguna village.

Karnaphuli river is navigable throughout the year by boats of about 4 tons to Kasalang, a distance of 100 miles from its mouth. About 20 miles above Kasalang navigation is stopped by Barkal rapids. Above Barkal, the stream narrows, its course being north until the Demagiri falls, three days' journey from Barkal, are reached, above which, the river becomes insignificant.

The chief tributaries are Kasalang, Chingri, Kaptai, and Rankheong rivers, of which the two first are navigable by boats. Below Barkal rapids, the Karnaphuli flows in a bed composed of mud and sand, and its banks, covered with jungle, rise to a height of 60 feet. The tide is felt as far as Kasalang, and the stream is sluggish except during the rains, when it is rapid.

Western bank (*Lat. 22° 14′ N., Long. 91° 48′ E.*).—From Patunga beacon the western bank of the river trends eastward for three-quarters of a mile, and then turns to the northward for 2 miles to Goaptu point, eastward of which Active spit extends for a distance of about three-quarters of a mile into the river.

Between Goaptu point and Chittagong six creeks enter the river on the western bank.

Eastern bank.—A creek, navigable by large boats, enters the river close to Norman point, and near its mouth is Pavki village, with another half a mile eastward of it, which has a large and conspicuous tree near its western end.

From Norman point the eastern bank of the river curves northward for a distance of $2\frac{4}{10}$ miles to Júldia hill, and northward of the point large mud flats stretch out into the river, and embankments have been constructed to prevent inundation; there are several small villages on this bank.

The eastern bank from abreast Goaptu point becomes low and swampy, but is cultivated; mud islands, known as chars, the largest

General charts 829, 70.

of which are Goaptu and Lukia islands, lie off this bank, with a boat passage at high water between.

Tide gauge.—Off Júldia hill station, on the edge of the mudbank, is a tide gauge marked in 3 feet divisions, by which the tidal signals governing the entry and departure of vessels are made.

Coombs pillar (*Lat. 22° 15′ N., Long. 91° 50′ E.*), about 8 cables northward of Júldia hill, on the highest part of the ridge, is 15 feet high, painted white, and surmounted by a lantern about 118 feet above high water.

Entrance.—Middle bank, a mud flat, 2 1/10 miles in length in a north-east and opposite direction, and about half a mile in greatest width, the highest part of which is awash at high water, spring tides, occupies the middle of the entrance, between the sand and mud flat extending southward of Patunga point and the mud flat off Norman point, and there is a channel into the river on each side of this flat, the outer bars being at the seaward entrance of the channels.

Bars.—Depths.—The outer bar of the northern of the two channels, which is the deeper, and that generally used had a depth of 11½ feet over it in 1910; the outer bar of the southern channel has a charted depth of about 8 feet.

The inner bar, above Middle bank, had a depth of about 9 feet over it in 1910, but the bars are subject to changes, and in 1903 vessels of from 25 to 26 feet draught could enter the river at high water, spring tides from May to September; but in the dry season at neaps it only admitted vessels of about 18½ feet draught. A large steam dredger is used for the improvement of the channels.

The water is lowest from November to June, and the depths are about 2 feet greater from July to October; in strong south-westerly winds a confused and dangerous sea breaks on the outer bars.

Beacons.—Leading beacons mark the channels of the river as far as Goaptu crossing, eastward of Goaptu point. The front beacon for use in crossing the outer bar of the northern channel is situated about 2 cables north-westward of Coombs pillar, and is a pole beacon surmounted by a white disc.

The rear beacon on a hill, 237 feet high and 1 1/10 miles from the preceding, is a pole beacon surmounted by a black diamond; these beacons are in line N. 40° E., and lead over the outer and inner bar. (*View A on 84.*)

Batten beacon, about 2 cables south-westward of Coombs pillar, is a beacon with horizontal cross pieces, and in line with Coombs pillar bearing N. 49° E. leads over the inner bar. (*View B on 84.*)

Plan 84, Karnaphuli river. Var. 1° 0′ E.

Two beacons for leading eastward of Active spit are situated on the east bank of the river, about 9 cables eastward of Goaptu point. The front beacon is a pole beacon, surmounted by a triangle, apex upwards, and painted white.

The rear beacon, a cross surmounted by a ball, painted white, in line with the front beacon bearing N. 24° E., leads eastward of Active spit. (*View C on 84.*)

The front beacon for leading over Goaptu crossing is situated about a cable north-westward of the preceding cross and ball beacon, and consists of a white tripod surmounted by a drum; when in line with the rear beacon for crossing the outer bar (black diamond), bearing S. 79° E., it leads over Goaptu crossing. (*View D on 84.*)

Buoys.—A fairway buoy, painted black, is moored on the line of the leading beacons on the outer edge of the outer bar.

The channel of the river to Chittagong is marked by red buoys on the starboard hand, and black buoys on the port hand, entering from seaward, but the buoys are liable to be washed away, and are moved as changes occur.

Anchorages (*Lat. 22° 15′ N., Long. 91° 50′ E.*) are charted in the reach southward of Active spit, in a depth of about 42 feet, and westward of the South-west end of Goaptu island, in about 36 feet, and the anchorage fronting the town is about 3 miles in length, with depths of from 18 to 36 feet, but an area of rocky bottom, at Ring bar, near the western end of the town, affords no anchorage.

Moorings.—There are 3 fixed and 8 swinging sets of moorings for large vessels below Chittagong. The mooring buoys are painted black, and are much larger than the buoys marking the channel.

Tug.—A tug is available.

Pilots.—In the South-west monsoon pilots cruise in their cutter by day, weather permitting, from the outer bar of Karnaphuli river to Sangu river mouth. In the North-east monsoon the cutter remains at her station by day and night, 3 miles south-westward of the outer bar buoy. The pilot cutter carries a red and white flag at the masthead.

Directions.—As the entrance of the river is liable to constant change, the bar cannot be crossed or the river navigated without local knowledge, and it should not be attempted without a pilot. The leading beacons, which have been already described, and sketches of which are given on the Admiralty plan, should be a guide when entering the river.

The best time to cross the bar is at high water slack, and next to this, on the first of the ebb. The tidal streams set across the outer part of the bar, the flood north-north-eastward, the ebb south-south-westward, and at springs, the flood streams are strong, and are apt to sweep vessels northward and westward of the river entrance.

Sailing vessels are sometimes detained, in leaving the river during the South-west monsoon, owing to the unfavourable wind. A land breeze from the northward may generally be expected at night.

Tides.—It is high water, full and change, on the outer bar at Karnaphūli river entrance, at about 0h. 30m.; springs rise 14 to 16 feet, and neaps 9 to 11 feet.

At Júldia tide pole it is high water at 0h. 40m.; springs rise 13 to 15 feet, neaps 7 to 10 feet.

At Government pier, Chittagong, it is high water at 1h. 12m.; springs rise 12 to 14 feet, neaps 6 to 8 feet; the rise given is above the zero of Júldia tide gauge, which is equivalent to low water springs of the dry season (November to April).

During the South-west monsoon, April to October, extraordinary spring tides have been known to rise as much as 19 feet above the zero.

The tides at Chittagong are subject to a large diurnal inequality, which may either accelerate or retard the times of high and low water, sometimes more than an hour.

From September to March the night tides are higher than the day tides; in December and January at springs the difference is about 2 feet.

From March to September the day tides are higher than the night tides: the difference is greatest in June and July at springs.

Tidal streams.—At about half a mile westward of the outer bar, the flood stream sets north-north-west and the ebb stream south-south-east.

The tidal stream turns about 1½ hours after high and low water near Júldia; and 1¼ hours after high and low water at Chittagong. During the rainy season, April to September, the rate of the ebb stream is great. Under ordinary conditions the rate of the tidal streams is about 2 knots at neaps, and 3 to 4 knots at spring tides.

TOWN (*Lat. 22° 19' N., Long. 91° 49' E.*).—The town of Chittagong, also known as Islamabad, is one of the most picturesque towns in the plains of India, being large, beautifully situated, and interspersed with trees and tanks. The European houses are built on hills 150 to 200 feet high, covered with vegetation, and in the hollows are native huts amidst fruit trees.

The town, extending over an area of 4½ square miles, is a collection of small villages interspersed with paddy fields and small hills, but in the European portion are gardens, a church, and hospital, and

Plan 84, Karnaphuli river. Var. 1° 0' E.

the offices of the Assam-Bengal railway, and being not only the principal civil station in the district, but also the administrative headquarters of a division, it contains a number of offices and numerous buildings of modern date; there is also an old fort and several mosques.

The town is badly lighted, but a scheme of electricity is proposed, using the river water as power. In 1901 the population was 22,104.

Communication.—The steamers of the British India Company, between Calcutta and Rangoon, call weekly, and touch at Akyab, Kyaukpyu, and Sandoway, and there is also a regular service to these ports by vessels of the Asiatic Steam Navigation Company. The Bengal Steam Navigation Company run steamers between Chittagong and Burmese ports. Steamers of the Clan line visit the port regularly.

Chittagong is the terminus of the Assam-Bengal railway. There is railway communication with Calcutta by a branch line from Laksham, 81 miles from Chittagong, to Chandpur, thence by steamer to Goalunda, from which the Eastern Bengal railway runs to Calcutta.

There is a daily post to Calcutta, and telegraphic communication with all parts.

Coal and supplies.—From 100 to 500 tons of coal are kept in stock, and about 1,000 tons imported annually; there are 30 lighters holding from 25 to 150 tons. Arrangements for oil fuel can be made with the Burma Oil Company.

Fresh provisions may be procured at Chittagong at moderate prices, and fresh water is supplied by the Port department; water of good quality may be obtained from the Railway jetty and from the Port depôt; there is also a steam water boat. For washing purposes the water in the river at the last of the ebb, about 2 miles above the town, is sufficiently good. Ship chandler's stores are procurable.

Pier (*Lat. 22° 19' N., Long. 91° 49' E.*).—The railway wharf at Chittagong is 360 feet long, with a depth of 25 feet alongside it at low water ordinary springs. There are 4 hydraulic cranes at the wharf, 3 of which can lift 1¾ tons, and one 5 tons at full radius and 10 tons at half radius. There are sheds on the wharf in which about 5,000 tons of cargo might be stored.

Only 3 jetties are available for ocean steamers, and one of these is reserved for steamers of the Clan line.

Storm signals are shown from the town port flagstaff and Júldia signal staff. *See* pages 74-76.

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Plan 84, Karnaphuli river. Var. 1° 0′ E.

Repairs.—Ordinary repairs can be executed to boilers and machinery, and there are sheers which will lift 12 tons. Vessels up to about 1,400 tons can have their bottoms repaired by beaching on a bank of hard sand. Important repairs could probably be carried out by the Assam-Bengal Railway Company's works, which are situated about 4 miles from the town and connected by railway. Carpenters are procurable.

Hospital (*Lat. 22° 19′ N., Long. 91° 49′ E.*).—Seamen are treated at the municipal hospital.

Quarantine.—Vessels with plague must anchor at Júldia until inspected by the health officer.

Trade.—The chief exports are rice, jute, and tea; and the imports salt, railway materials, and kerosene oil.

All cargo is loaded and discharged at the wharf, or by means of lighters and native boats.

Health.—The native town of Chittagong is considered unhealthy from the malaria arising from stagnant pools and tanks, and also from the extensive chars, but the port is not worse in this respect than other river ports of India. Vessels visiting Chittagong are permitted the attendance of a government surgeon at a moderate charge.

The most unhealthy period of the year is September, or towards the close of the rainy season, when fever is prevalent. In April and May epidemics of smallpox and cholera are common. An easterly wind, if of long continuance, is said to be unhealthy. *See* Climate, Chapter I., page 39.

Winds, weather, and climate.—During the South-west monsoon the rainfall is generally heavy, averaging 105 inches. A sea breeze usually prevails during the day and renders the air comparatively cool. The atmosphere is frequently saturated with moisture, causing heavy dew at night and occasionally dense fogs.

South-westerly winds prevail from March to May; south-easterly to south-westerly from June to September; and north-easterly from October to February. The weather is fine and settled from the middle of October to March; but towards April the wind becomes more easterly, with occasional heavy north-westers in the afternoon. After about the end of April the South-west monsoon blows fresh in the upper part of the Bay of Bengal; but there are land and sea breezes near the land in the north-eastern part of the bay.

Near Chittagong, in the forenoon, the wind generally blows from the south-eastward, and is moderate; towards the afternoon it freshens and veers to the south-westward. In June and July, the

Plan 84, Karnaphuli river. Var. 1° 0′ E.

South-west monsoon blows hard from south-south-east to south-west, with rain, leaving now and then a few comparatively fine days.

Cyclonic storms.—Although Chittagong is in the track of cyclones, serious injury is not often caused by them. But in 1849, 1872, and 1876 severe cyclones, accompanied by storm waves, worked great havoc in the district, and much damage was similarly caused in 1897.

Chart 859, Matla river to Elephant point.

COAST.—From Chittagong lighthouse, which is situated 1¼ miles southward of Norman point, the coast trends south-south-eastward for a distance of 4½ miles to the northern entrance point of Sangu river; this point is broad, flat, and fringed with extensive sand flats.

Sangu river (*Lat. 22° 7′ N., Long. 91° 50′ E.*).—The entrance to Sangu river, though almost filled with sandbanks at low water, appears, when these banks are covered, to be about 3 miles wide. The river is navigable by large cargo boats throughout the year, and connects some distance up by a partly artificial channel with the Karnaphuli river.

Coast.—The coast southward to Kutubdia island is low and without any noticeable marks; at about 9 miles from Sangu river northern entrance point, it recedes and is broken up by numerous shallow streams.

KUTUBDIA ISLAND, the north point of which is about 12 miles southward of Sangu river northern entrance point, is 12 miles in length in a north and south direction, and from 2 to 4 miles in width; it is low and level, covered with trees, and visible from a distance of about 8 miles. The island, being liable to inundation, is protected by a ring of embankments from encroachment by the sea.

The channel inside Kutubdia island, about 2 miles in width, appears blocked, but there may be an entrance from the southward.

LIGHT.—On the western side of Kutubdia island and about 2 miles from its north-western point, a brick tower, 136 feet in height, painted with its lower storey grey and its upper part in red and white horizontal bands, exhibits at an elevation of 121 feet above high water, a *white group-flashing* light with a period of system of *thirty seconds*, showing flash, *four seconds;* eclipse, *two seconds;* flash, *four seconds;* eclipse, *twenty seconds;* it should be visible in clear weather from a distance of 17 miles.

Shoal.—A shoal, with a depth of 3 fathoms over it, lies 7 miles north-north-west of Kutubdia lighthouse, and there are depths of 3¾ fathoms at one mile northward of it, and of 4 fathoms between it and Dolphin shoal.

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Chart 859, Matla river to Elephant point. Var. 1° 0′ E.

Tides.—It is high water at Kutubdia island at 11h. 56m.; springs rise 13 feet, neaps rise 9½ feet.

Dolphin shoal, nearly 4 miles westward of Kutubdia lighthouse, is about 2 miles in length in a north and south direction, half a mile in width, and has a depth of 4 feet over its shoalest part at low water.

The channel between the shoal and Kutubdia island is 3 miles wide, with depths of from 5½ to 7 fathoms.

Buoy.—A large conical buoy, painted white and surmounted by a small black cage, is moored in a depth of 4 fathoms, westward of the southern part of Dolphin shoal, and 4¼ miles westward of Kutubdia lighthouse.

This buoy is liable to be washed away.

Anchorage may be obtained in a depth of 7 fathoms with Kutubdia light bearing E.N.E., distant about one mile, approaching it with the lighthouse or light on that bearing; this leads over the northern part of a ridge with a depth of 4¼ fathoms over it, which is situated 3 miles south-south-westward of Dolphin shoal and is so narrow that the lead may easily miss it. The anchorage is fairly protected, but the tidal streams run as strongly as outside the shoals.

North patches (*Lat. 21° 42′ N., Long. 91° 45′ E.*) extend southward for a distance of 12 miles in a broken tongue from their northern extreme, situated about 4 miles west-north-westward of the south point of Kutubdia island. The depth of water on North patches varies from 4 feet to 2¾ fathoms, over hard sand.

A channel about three-quarters of a mile wide, having depths of from 6 to 17 fathoms, separates North patches and the sands extending off the south end of Kutubdia and westward from Maiskhal island. The tidal streams rush at a great rate through this channel, and it should not be attempted without local knowledge.

SOUTH PATCHES are three heads of hard sand extending for about 5 miles in a north and south direction, the northern patch, with 1¼ fathoms water over it, being 10 miles westward of the north end of Sonadia island. The middle of these heads, having a depth of 3 fathoms over it, is about 1¾ miles southward of the northern patch, and the southernmost head, with 4¾ fathoms over it, at low water is 2½ miles distant from the middle head.

In fine weather, there are generally rollers near the South patches, and in a fresh breeze the shoaler parts have breakers upon them. Around South patches, there are depths of 6½ to 10 fathoms, over mud.

General charts 859, 70.

Chart 859, Matla river to Elephant point. Var. 1° 0′ E.

LIGHT-VESSEL.—A light-vessel, painted red, with a black ball at the masthead, and *South patches* lettered on the sides, is moored south-west of the shoal, and exhibits a *white fixed* light, which should be visible in clear weather from a distance of 11 miles.

A *blue* light is burnt *every half-hour* from 7 p.m. to 5 a.m. The light-vessel is removed annually from the end of December to the middle of March, and replaced by a conical buoy, painted red and surmounted by a staff and cage.

Buoy.—A conical buoy, painted red, and surmounted by a white cage, is moored in a depth of 9 fathoms, about one mile south-westward of the 3-fathom patch of South patches; it is liable to be washed away.

Trifels shoal.—A shoal, with a depth of 5½ fathoms over it, was reported (1907) to exist about 14 miles south-westward of South patches.

Tides.—At South patches, springs rise 12 feet.

Tidal streams.—The flood or north-going stream continues to run northward and north-eastward for one hour after high water, and the ebb or south-going stream runs south-south-westward and south-westward for 1½ hours after low water. At springs the streams run northward and southward; at neaps the streams gradually turn in the direction of the hands of a watch. In the fine season more westerly than easterly set is experienced. The rate of the ebb at springs is estimated at 4 to 6 knots; and at neaps about 2½ knots an hour.

MAISKHAL ISLAND, the northern part of which is south-eastward of Kutubdia island, with Mattabari island between, is 13 miles long and 6 miles broad, and through its centre and along the eastern coast is a range of low hills, about 300 feet high, but the west and north coasts are low-lying and fringed by mangrove jungle; the greater part of the island belongs to a permanently settled estate. In 1901 the population was 22,228.

Maiskhal village, the police head-quarters, has a shrine dedicated to Siva, and on the same hill is a Buddhist pagoda.

Garamchori hill, near the middle of the eastern part of the island, is 288 feet in height, but as the range is somewhat uniform it is not remarkable.

Plan 3456, Cox's Bazar.

Maiskhal channel (*Lat. 21° 30′ N., Long. 91° 58′ E.*), separating Maiskhal island from the mainland, is $1\frac{1}{10}$ miles in breadth, at the southern point of that island, but the deeper part, with 5 fathoms water, is only 3 cables in breadth, and lies on the eastern side; this channel extends to Baghkhali creek, where it is narrowed to the breadth of one cable.

Sonadia island, situated 2 miles off the south-west extreme of Maiskhal island, is 3½ miles in length in a north-west and opposite direction, and about 2 cables in width; it has white sandhills from 5 to 15 feet high, and two conspicuous cocoanut palms near its southern end.

Red Crab island, one mile in length, is narrow, sandy, and lies close to the south-east point of Maiskhal island; a large fishing village is situated on the island.

Rupadia sands, forming the south-west side of the entrance to Maiskhal channel, extend from the southern coast of Maiskhal island, and cover at high water, except a small patch awash at their northern end.

The sands are triangular in shape, 2½ miles in length in a north and south direction, about one mile in breadth, and the sea generally breaks over them.

Inner spit, about half a mile in length, in a north and south direction, its northern part awash at high water, and always visible, lies about 3½ cables south-eastward of the south point of Rupadia sands, part of the channel between having depths of from 3½ to 5¼ fathoms.

Middle shoal, about 1¾ miles in length in a north-east and opposite direction and 4 cables in breadth, is composed of sand and mud, with depths of from one foot to 12 feet over it, and lies midway between Red Crab island and the mainland.

Middle sands, half a mile in length in a north and south direction, and 2½ cables in breadth, dries at low water, spring tides, and is situated near the southern end of Middle shoal.

Baghkhali creek, running into Maiskhal channel opposite Red Crab island, is narrow, shallow, and nearly dries in places at low water spring tides.

Beacon (*Lat. 21° 26′ N., Long. 91° 59′ E.*).—Cox's Bazar beacon, consisting of a wooden post, surmounted by a cross, painted white, is 174 feet above high water, and situated on the northern part of the coast range of hills; it is not easily distinguished from beyond a distance of 4 miles.

Entrances.—Depths.—The principal entrance to Maiskhal channel is situated between the Inner spit and the mainland, over a bar of sand, which probably shifts during the South-west monsoon; in 1902 there was a depth of 12 feet at low water, spring tides in this channel.

Plan 3456, Cox's Bazar. Var. 1° 0′ E.

The channel between Rupadia sands and Inner spit had, in 1902, a depth of 7 feet over its bar. There are generally heavy rollers off the entrance to Maiskhal channel, which within the depth of 3 fathoms break occasionally on parts of the bar.

Anchorage.—Vessels of deep draught can anchor in a depth of 5½ fathoms, over sand and mud bottom, at about 3½ miles off Cox's Bazar, with the two cocoanut palms on Sonadia island bearing N.N.W. ⅜ W., and Cox's Bazar beacon E. by N. ½ N.

The anchorage for vessels of light draught is in 3 fathoms water, over sand and mud bottom, at half a mile from the shore, with the four conspicuous casuarina trees, situated 1¼ miles north-north-west of Cox's Bazar, bearing N. ½ E., and Cox's Bazar beacon E. by S. ⅝ S.; or anchorage may be taken up off the entrance to Baghkhali creek in a depth of 4 fathoms, over mud.

Directions.—Reliable pilots for Cox's Bazar cannot be obtained, and as the bar probably shifts its position, the channel should be examined and buoyed before entering. According to the position of the bar as at present known, the following directions are suitable:—

Approach the coast with the north extreme of White cliffs bearing East until the summit of Cox's bluff bears North, when steer for it until the four conspicuous casuarina trees bear N. by W. ⅛ W., and then alter course to N.N.W., keeping from 7 cables to half a mile from the shore, until the anchorage for vessels of light draught is reached.

If intending to anchor off Baghkhali creek, the anchorage off Cox's Bazar should be left at half tide, when the edge of Rupadia sands will be visible, and the channel should be crossed, steering N.W. by W., avoiding the Inner spit. Follow round the edge of Rupadia sands, and that of those extending from Maiskhal island, at a distance of about 1½ cables, until the south end of Red Crab island bears West, when cross the channel, keeping clear of Middle shoal, and proceed to the anchorage.

Tides.—It is high water, full and change, in Baghkhali creek at 10h. 35m.; springs rise from 11 to 12 feet; neaps rise from 7 to 9 feet.

COX'S BAZAR (*Lat. 21° 27′ N., Long. 91° 59′ E.*), prettily situated on a low range of sandhills, between Baghkhali creek and the sea, where it has a long open beach, is likely to become a popular health resort for Chittagong. The houses are well and solidly built of timber, raised on piles, and surrounded by verandahs, having somewhat the appearance of Swiss cottages; it has substantial offices, civil and criminal courts, and other buildings, and in 1901 the population was 3,845.

General charts 829, 70.

Plan 3456, Cox's Bazar. Var. 1° 0′ E.

Communication.—The Retriever Flotilla Company have a regular service of steam vessels with Chittagong twice weekly, and there is a post and telegraph office.

Supplies.—Small supplies of fresh provisions and water may be procured, and a large variety of fish, including pomfret, soles, and oysters, are obtainable.

COAST.—White cliffs.—The coast at a distance of 4 miles south-south-eastward of Cox's Bazar, forms cliffs of red earthy clay, which extend for a distance of 3¼ miles, with an average height of over 200 feet; South cliff, the highest part, is 270 feet high. Seen from seaward, these cliffs appear white, when the sun is shining on them, and as in clear weather they may be visible from a distance of 20 miles, they constitute a good landmark for vessels approaching Chittagong from the southward.

Tides.—It is high water, full and change, near White cliffs at about 11h. 0m.; springs rise from 9 to 10 feet.

Chart 859, Matla river to Elephant point.

Regu shoal, about 5 miles south-south-westward of White cliffs, is about 2 miles in length, in a north and south direction, and half a mile in width; it is composed of rock and hard sand, and has a least depth of 2¾ fathoms over it, at low water, spring tides.

ELEPHANT POINT (DOMBAK) (*Lat. 21° 11′ N., Long. 92° 3′ E.*), 9 miles southward of South cliff, has behind it a conspicuous hill, 410 feet high, which may be seen, in clear weather, from a distance of 20 miles.

A ledge of rocks extends for a distance of nearly 3 cables, and there is a depth of 5 fathoms at 6 cables from the point.

Signal station.—There is a signal station on Elephant point, belonging to the Indian telegraph department, and vessels can communicate by the International code.

Kohinur shoal, with a depth of 12 fathoms, over sand, was reported (1909) to exist at about 23 miles westward of Elephant point, and outside the 20-fathoms contour line.

General charts 829, 70.

CHAPTER VII.

COASTS OF ARAKAN AND BURMA.—ELEPHANT POINT TO CAPE NEGRAIS.

(*Lat. 21° 11' N. to Lat. 15° 57' N.*)
(*Long. 92° 3' E. to Long. 94° 14' E.*)
VARIATION : Decreasing about 3' annually.

Chart 3493, Cox's Bazar to Mayu river. Var. 1° 0' E.

COAST.—From Elephant point (*Lat. 21° 11' N., Long. 92° 3' E.*) the coast trends south-eastward for a distance of 11 miles to abreast Taungnyo (Quoin hill), which is 880 feet high and situated 2 miles inland, and thence south-south-eastward 22 miles to Shahpuri point, the south extreme of Shahpuri island.

Naaf peninsula, of which this coast is the western side, is from 2 to 5 miles in width and hilly; a conspicuous peak, 830 feet high, is situated on it, about 9 miles southward of Taungnyo, and near the south end of the peninsula are the North Twins, two remarkable casuarina trees.

A range of mountains, of which Walkyeingtaung, 1,515 feet high, and the northern end, is 11 miles east-north-eastward of Taungnyo, stretches southward in a direction almost parallel to the coast, but gradually drawing towards it; the general heights of the summits are from 1,000 to 2,260 feet.

Depths off-shore.—The 10-fathoms contour line, which is about 6 miles from Elephant point, gradually draws off the land, and is about 11 miles westward of the west coast of Shahpuri island; inside it the depths, principally over a muddy bottom, shoal evenly to the coast, without any outlying dangers, except Shahpuri flat, which commences immediately northward of Shahpuri island.

Plan 3476, Naaf river.

Shahpuri island, about 4¼ miles in length in a north-west and opposite direction, and 2¼ miles in greatest width, is low, flat, covered with jungle, and separated from the end of Naaf peninsula by a narrow creek, which dries in places at low water; South Twins, two conspicuous trees, about 80 feet high, are near its south-west side, and Badar clump of casuarina trees, about 90 feet high, is close to Shahpuri point.

Shahpuri flat, of sand and mud, with general depths of from 1¼ to 2¾ fathoms over it, is triangular in shape, and from the coast of Naaf peninsula, about 6 miles north-westward of Shahpuri point, its edge has a southerly direction for about 8 miles to the apex, which is 5 miles south-westward of Shahpuri point; its southern part forms the bar at the entrance to Naaf river.

A shoal part, on which the depths are less than one fathom, extends about a mile westward of the South Twins, and breaks, and there are generally heavy rollers on the flat, which also often breaks in a depth of 2 fathoms.

Cypress point, the eastern entrance point to Naaf river, is low and sandy, and close to it is a Cypress clump, of casuarina trees, about 80 feet high. Best clump, the trees of which are about 80 feet high, is a conspicuous clump about 3 miles south-eastward of Cypress point.

Cypress sands, a number of ridges, some of which uncover at half tide, and others that dry at low water, spring tides, lie on a bank nearly 3 miles in width, with depths under 3 fathoms, which extends about 3½ miles west-south-west of Cypress point, and the same distance southward of it; these sands form the south side of the channel into Naaf river, after crossing the bar, and when dry are seen by the broken water over them.

NAAF RIVER (*Lat. 20° 43′ N., Long. 92° 22′ E.*), entered between Shahpuri and Cypress points, nearly 1¼ miles apart, as far as surveyed, a distance of about 11 miles from its mouth, flows in a south-south-east direction, and has no outlying dangers in it.

Bar.—Depths.—The bar, which is formed between the south point of Shahpuri flat and the west extreme of Cypress sands, is about 6 miles south-west of the entrance, and in 1903 had a depth of 13 feet over it at low water, spring tides. Inside the bar, and about 4 miles from the entrance, the depths increase to from 3¼ to 4¾ fathoms, and between the entrance points there is a vein of deep water with from 11 to 17 fathoms, but the general depths in mid channel of the river are from 5 to 8 fathoms.

Buoys.—A buoy is moored, in a depth of 13 feet, on the southern side of the bar, and is about 4½ miles west-south-westward of Shahpuri point.

An inner buoy is moored in 28 feet water, on the north-west edge of Cypress sands, and on the south side of the channel; it is nearly 3 miles south-westward of Shahpuri point.

No dependence should be placed in finding these buoys in position.

Plan 3476, Naaf river. Var. 1° 0′ E.

Directions.—Approach the bar with Best clump, the most conspicuous clump of trees south-eastward of the entrance, bearing N. 87° E., and when the north-east point of St. Martins islands bears S. 14° E., alter course to N. 61° E., passing about a quarter of a mile northward of the north edge of Cypress sands, and when Shahpurī point bears N. by W. steer to enter the river in mid-channel.

A channel with somewhat deeper water exists close westward of the western edge of Cypress sands, but it is too narrow to be attempted unless previously buoyed.

Anchorage.—The anchorage off Maungdaw, the principal town, is in a depth of about 4½ fathoms.

Tides.—It is high water full and change at St. Martins islands at 9h. 28m.; springs rise from 8 to 10 feet, neaps rise from 6 to 8 feet. High water is 40m. later in Naaf river.

Tidal streams.—The tidal streams set across the entrance to the bar; the flood to the northward, and ebb to the southward, at rates of from three-quarters of a knot to one knot at springs.

Town.—Maungdaw, the principal town in this district, is situated on Tat creek, on the eastern side of the river, about 7 miles from its entrance; in 1908, the population was about 1,735.

Communication.—Steam launches communicate with Akyab and with Ucha, at the head of Naaf river, and there is a post and telegraph office.

AKYAB DISTRICT.—Boundary.—Naaf river is the boundary between Bengal and Burma and the north-west limit of Akyab district, the coastline of which extends about 65 miles southward of its entrance.

Chart 3493, Cox's Bazar to Mayu river.

ST. MARTINS ISLANDS (*Lat. 20° 36′ N., Long. 92° 20′ E.*), a group 3¾ miles in length, in a north and south direction, and 7 cables in greatest breadth at the northern end, consist of one large and two very small islets, connected by ledges of sand and rock, which dry at low water.

There is a clump of trees near the southern end of the group, several casuarina trees on other parts, and at the north end is North tall tree, about 110 feet high.

Landing.—Good landing may be effected at the northern end.

St. Martins reef, situated 5½ miles westward of the northern St. Martins island, is a long ridge of rocks, one of which is awash at low water, spring tides; the reef breaks in heavy weather and with a southerly swell, but does not always do so in the North-east monsoon.

General charts 829, 70.

Chart 3439, Cox's Bazar to Mayu river. Var. 1° 0′ E.

Foul ground extends 4 cables westward, 6 cables southward, 4 cables eastward, and 2$\frac{4}{10}$ miles northward of the rock awash, the northern patches being detached with depths of 5 fathoms over them.

North Delay shoal, a small patch of hard ground, 4 cables in length in an east and west direction, and 2 cables in width, has a least depth of 4 fathoms over it, and lies 6½ miles south-westward of the south point of St. Martins islands.

South Delay shoal, a ridge with very irregular depths over it, but on which the least water obtained was 5¼ fathoms, lies about 2 miles southward of North Delay shoal; as pinnacles with a less depth may exist in this locality, it should not be crossed.

COAST.—Sitarparokia (Black hummock), about 12¼ miles south-eastward of Cypress point, is a small conical hill, 224 feet high, having the ruin of a temple on its summit; the hill appears black when seen from the southward. A conspicuous rock, 20 feet high and shaped like a chair, lies half a mile north-westward of Sitarparokia, and one cable from the shore.

Sitarparokia patches, about 4¾ miles in extent, in a north-north-west and opposite direction, with a greatest breadth of 2½ miles, have a least depth of 1½ fathoms over them, which is near the northern end, and about 7 miles from Sitarparokia, nearly on a line joining that hummock with the south point of St. Martins islands. There are depths of from 4½ to 5 fathoms between them and the mainland, and from 5½ to 7 fathoms between them and St. Martins islands.

Asirgarh shoal, a small rocky shoal, about half a mile in extent, and on which there is a depth of less than one fathom, lies about 6½ miles south-westward of Sitarparokia, and breaks at low water and in heavy weather.

A patch of 5¼ fathoms lies 1⅔ miles west-north-west of Asirgarh shoal.

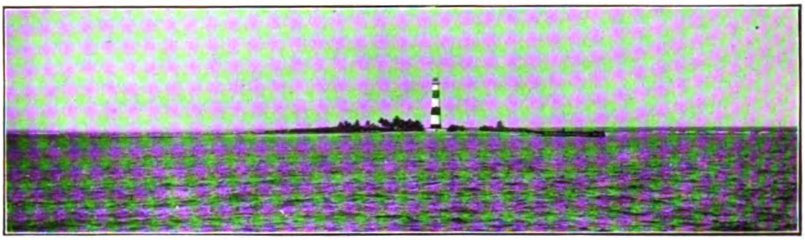
Taylor shoal, 2¾ miles in length in a west-north-west and opposite direction, and 1¼ miles in breadth, has a least known depth of 4¼ fathoms, which lies 7¾ miles north-westward of Oyster island lighthouse, but as the depths over the shoal are very uneven, less water may exist, and vessels should avoid passing over any part of it.

Chart 821, Elephant point to Chedúba strait.

Oyster island (*Lat. 20° 12′ N., Long. 92° 32′ E.*), situated 21 miles south of Sitarparokia, is low, rocky, and of small extent, with a few low trees on its summit, and stands on the eastern edge, and near the centre, of a ledge of rocks, one mile in length in a north and south direction and 3 cables in width.

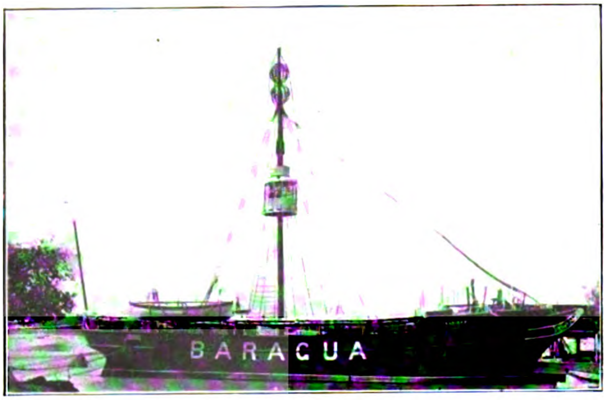
General charts 829, 70.

(a)



Oyster island from the eastward.

(b)



Baragua flats light-vessel.

Chart 821, Elephant point to Chedúba strait.

The bank surrounding the island, inside the 5-fathoms contour line, is about 1½ miles in breadth, and extends the same distance north-west of the island and 3¼ miles south-east of it; inside the 5-fathoms line are several shoals with from 1¼ to 3¾ fathoms water over them, and uneven bottom. A rocky patch of the former depth is situated 3 miles south-eastward of the lighthouse.

Oysters are plentiful on the island.

Chart 3493, Cox's Bazar to Mayu river. Var. 1° 0′ E.

LIGHT.—From an iron tower, 141 feet in height, painted black and white in alternate bands, black at base, with white dome, and situated on eastern side of the centre of Oyster islands, is exhibited, at an elevation of 130 feet above high water, a *white and red occulting* light, with a period of system of *thirty seconds*, thus:—light, *twenty-eight seconds*, followed by an eclipse of *two seconds'* duration, showing *white*, except from N. 34° W. to N. 49° W., over Oyster reef, where it is *red*. The light should be visible from a distance of 17 miles in clear weather. A flagstaff, some buildings, and low trees are near the lighthouse. (View *a*, page 337.)

Pier.—Landing.—Good landing may be effected in fine weather at an iron pier which extends from the north-east side of the island.

Plan 3508, Mayu river.

MAYU RIVER (*Lat. 20° 13′ N., Long. 92° 45′ E.*), from a position about 11 miles from its entrance, between Foul and Mayu points, 1⅓ miles apart, for which distance it has been surveyed, flows about due south, and from about a mile within its mouth the river is divided, for a distance of 8 miles, into two channels by Paw Kyun Thi island, and a shoal extending south of it; as far as Paw Kyun Thi island the river is about 1¾ miles wide, but above that island it narrows.

Kywide river, the eastern arm, which has been surveyed for a distance of 4 miles, is about one mile in breadth at that part, and flows in a west-south-west direction, joining the Mayu river immediately inside its entrance.

Aspect.—The coast range northward of Mayu river, which stretches from that direction parallel to the coast, has sharp summits, but these terminate 3 miles northward of Foul point, in a hill known as Fakirmura, 435 feet high, and easily recognised.

Mount Todd, 1,109 feet high, and 4¼ miles northward of Fakirmura, when seen from the westward appears to be flat topped and slightly higher than the summits on either side of it, but from the southward it has the appearance of a conspicuous sharp peak.

General charts 829, 70.

Plan 3508, Mayu river. Var. 0° 50′ E.

The Agandu range, 631 feet high, situated between the Mayu and Mosi rivers, and 7 miles east-north-eastward of Fakirmura, is flat topped and crowned by a pagoda.

Chart 3493.

Bengara, a conspicuous peak, 1,356 feet high, is 19 miles north-eastward of Fakirmura, and when open southward of it is easily recognised.

Plan 3508.

Dangers.—Martini sands, on which are Burne rocks, and several patches which dry from one foot to 8 feet, extend for a distance of nearly 4 miles in a southerly direction from Foul point, with a general breadth of 2 miles. These sands lie on the eastern side of a triangular-shaped bank, which, leaving the coast about 5 miles north-north-westward of Foul point, stretches in a southerly direction for a distance of about 12 miles and terminates in North spit, the point of which forms the western side of the bar; from North spit the bank, with Martini sands, forms the western side of the channel into the river.

Mayu spit, which is awash at low water, spring tides, extends in a south-west direction, for a distance of 2 miles from Mayu point; it also lies on a triangular-shaped bank, which, at 4½ miles south-westward of Mayu point, terminates in South spit, the point of it forming the eastern side of the bar.

Bar.—Depths (*Lat. 20° 9′ N., Long. 92° 43′ E.*).—The bar between North and South spits is about a quarter of a mile in width, and has a depth of 19 feet at low water, spring tides; inside, the channel widens to 1½ miles, but contracts to about two-thirds of a mile near Mayu point, widening again in the river.

The depths increase inside the bar to 5 fathoms, and to nearly 13 fathoms westward of Mayu point, shoaling again in the river to 5 and 6 fathoms at the anchorage between Foul point and the point of the shoal extending from the dividing point between Mayu and Kywide rivers.

The channel eastward of Paw Kyun Thi island and the shoal extending from it has a depth of 19 feet, and, although much obstructed by fishing stakes, is the easier to navigate. The channel to the westward of island and shoal has a depth of 20 feet, but its southern entrance is narrow and dangerous.

The depths in Kywide river are from 5 to 7 fathoms.

Anchorages.—Good anchorage may be obtained eastward of Burne rocks, in depths of from 6 to 9 fathoms, also in a depth of 5 fathoms just to the southward of Nganabya creek, nearly a quarter

Plan 3508, Mayu river. Var. 0° 50′ E.

of a mile off the east bank, or in 4 fathoms at about the same distance off the west bank, opposite Rathedaung.

Directions.—The leading mark for crossing the bar is a distant bluff in line with a wooden pagoda, 217 feet high, bearing North; the pagoda is situated about two-thirds of a mile eastward of Fakirmura, and at the right tangent of a clump of trees, which position makes it difficult to distinguish. (*View on plan 3508.*)

When Bengara comes in line with Pimple hill, bearing N. 32° E., steer for it until Mayu point bears S.S.E., when alter course to pass eastward of Burne rocks. Pimple hill is situated about 1½ miles south-eastward of Agandu. (*View on plan 3508.*)

If proceeding to Rathedaung, course may be shaped to pass on either side of Paw Kyun Thi island, observing, as already mentioned, that the eastern channel is the better of the two.

Tides.—It is high water, full and change, at Foul point at 9h. 47m.; springs rise from 8 to 9 feet, neaps rise 6 feet; neaps range from 2 to 3 feet. It is high water from 15 to 20 minutes earlier at the bar.

Tidal streams.—The tidal streams at the bar have a rate of about 2½ knots at springs and 1½ knots at neaps, the flood setting in a north-north-east, and the ebb in an opposite, direction. In the river the streams attain a rate of 3½ knots at springs.

Rathedaung town is situated on the north bank of Rathedaung creek, which enters by the east bank of the river at 12 miles above Foul point; it has a population of about 1,200.

Communication.—There is communication with Akyab by steam launches, and a post and telegraph office.

Chart 821, Elephant point to Chedúba strait.

OYSTER REEF (*Lat. 20° 5′ N., Long. 92° 38′ E.*), nearly 12 miles south-westward of Foul point, is a dangerous reef, about 2½ miles in length in a north-west and opposite direction, between the 5-fathoms contour line, on which a depth of 4 feet has been reported, but the least depth found at the survey, in 1904, was 1¼ fathoms; it always breaks in bad weather, or if there is any swell.

It is covered by a *red* sector from Oyster island light.

The channel between Oyster reef and the foul ground extending south-eastward of Oyster island is 4½ miles wide, with depths of from 7 to 8 fathoms.

Heckford patch, 1½ miles in length in an east and west direction, is composed of rock, and the least water found over it in 1904 was 5 fathoms, which was situated 8¾ miles south-south-east from the

General charts 829, 70.

Chart 821, Elephant point to Chedúba strait.

shoalest part of Oyster reef; a depth of 4¼ fathoms has been reported on this patch, and as the bottom is very uneven, vessels should not attempt to cross it.

Clearing marks.—Beacon hill (Prine Daung), bearing E. by N., leads one mile northward, and the same hill N.E. by E. ⅜ E. leads one mile southward of the foul ground.

Plan of Arakan river on 1884.

ARAKAN RIVER is formed by the Kaladan and Arakan rivers, the former being the name of the main river as far as Akyab; it is the largest and most important of the rivers which rise in the Arakan hills. The port and town of Akyab are immediately within the entrance on the western side of Kaladan river.

Fakír point, on the western side of the entrance, and nearly 10 miles south-eastward of Mayu point, is low, as is also the land within it, which is cultivated and covered with cocoanut groves. A flagstaff stands on Fakír point.

Savage island, on the eastern side of the entrance, is about 65 feet in height and one mile west-north-west of Hodge point, the eastern entrance point; Passage rock, 10 feet high, is about a quarter of a mile north-west of Savage island.

Peaked rocks, above water, lie a quarter of a mile south-westward of Savage island, and White rocks, also above water, stretch about a mile south-eastward from Peaked rocks; between this chain of rocks and Hodge point are flats, the western with a few feet water over it, and the eastern drying 2 feet.

LIGHT (*Lat. 20° 5′ N., Long. 92° 54′ E.*).—A cylindrical stone tower, 70 feet in height, painted white, with a red lantern and white dome, and situated on the north-western point of Savage island, exhibits, at an elevation of 118 feet above high water, a *white fixed* and *flashing* light, showing a flash *every minute;* it should be visible in clear weather from a distance of 16 miles.

Dangers.—From about 5 miles west-north-west of Fakír point, the edge of an extensive flat, with depths under 3 fathoms, extends in a southerly direction for a similar distance, and then forms a prong, the extreme of which is 4¼ miles south-south-west of Fakír point; the eastern edge of this flat forms the western side of the channel to the entrance to the river. The sea breaks heavily over the eastern part of this flat during the South-west monsoon.

Fakír reef, consisting of rocks which dry from 2 to 3 feet, extends about 3½ cables south-south-east of Fakír point.

General charts 829, 70.

Plan of Arakan river, with plan of Akyab on 1884. Var. 0° 50′ E.

The only outlying danger on the eastern side of the entrance is a rock with 5¼ fathoms over it, which lies 1½ cables north-westward of Passage rock, but near the outer bar, and eastward of the prong of the flat are two patches with depths of 3 fathoms over them, which lie $2\frac{1}{10}$ and $2\frac{3}{10}$ miles, respectively, south-south-west of Savage island lighthouse.

Outer bar.—Depths.—The Outer bar, which is situated between 2½ and 4½ miles southward of Fakír point, has shoaled in places as much as 2 feet but in 1906 in no place was there a less depth than 21 feet. Inside the Outer bar the depths increase to 6 and 8 fathoms, and between Fakír point and the shoals extending eastward of Savage island there are from 11 to 19 fathoms, from which the water shoals to 6¼ at the outer, and 4 fathoms at the inner, anchorages.

Buoys.—The outer buoy, moored in a depth of 22 feet on the Outer bar, is conical, painted black, surmounted by a staff and cage, and situated $2\frac{2}{10}$ miles south-south-west of Savage island lighthouse.

A conical buoy, painted black, and surmounted by a staff and cage, is moored off the south end of Fakír reef, and half a mile south-south-east of Fakír point.

Akyab port (*Lat. 20° 8′ N., Long. 92° 53′ E.*), situated northward of Fakír point, off the western bank of Kaladan river, and between it and the shoal water extending from Flat island, is about 2 miles in length, with a general breadth of about half a mile.

Inner bar.—Depths.—An inner bar, crossing the entrance from the south-west shore northward of Fakír point to the south-west extreme of the shoal extending from Flat island, has a least depth of 23 feet on the track recommended, and northward of it the depth gradually increases, there being 4½ to 5 fathoms off the town, and from 6 to 7 fathoms at the anchorage further north.

Inner dangers.—Saunders shoal, situated in mid-channel of the river, its south-west extreme being one mile eastward of Fakír point, is three-quarters of a mile in length, in a north-east and opposite direction, and 1½ cables in breadth; it has a least depth of 2¼ fathoms over it.

Buoy.—A conical buoy, painted red, and surmounted by a staff and cage, is moored, in about 20 feet water, off the south-west extreme of Saunders shoal, and 9 cables eastward of Fakír point.

Flat island, occupying the centre of the river, its southern side being about 5 miles north-eastward of Fakír point, is low and covered with brushwood.

Flat island spit, which dries at low water, stretches about 2¼ miles south-westward from the south-western side of Flat island, with shoal

General charts 829, 70.

Plan of Arakan river on 1884. Var. 0° 50′ E.

ground extending for a further distance of 1½ miles south-south-west of the southern extreme of the spit; it forms the eastern side of the channel opposite Akyab.

Buoys.—A conical buoy, painted red and surmounted by a staff and cage, is moored in a depth of 20 feet about a cable south-westward of the extreme of the shoal extending from Flat island spit.

Channel buoy, conical, painted red and surmounted by a staff and cage, is moored in a depth of 22 feet about 3 cables south-westward of Flat island spit, to mark the eastern side of the channel above Akyab.

Pilots.—Pilots, licensed by the Government of Burma, are stationed at Fakír point, and during the season when the port is much visited by vessels one will usually be found cruising outside the bar, the pilot boat being a whaler, painted white.

In the event of no pilot being available, vessels should anchor about one mile to the southward of the Outer bar buoy until one can be obtained.

Anchorage (*Lat. 20° 8′ N.; Long. 92° 53′ E.*). — Temporary anchorage may be taken up, in a depth of 5 fathoms, with Savage island lighthouse bearing S.S.W.; with North and South hummocks in line, bearing S. 38° E.; or anywhere after passing Fakír reef, taking care to avoid Saunders shoal; the deepest and largest area is south-eastward of Flat island spit, but owing to its distance from the town it is seldom used.

Merchant vessels usually anchor westward of Flat island spit, between the main wharf and Charugyea creek, at about 1½ cables from the shore, to facilitate working cargo, but, if this is not required, a convenient anchorage for vessels of less than 22 feet draught is off the hospital. The deepest water for large vessels is off Charugyea creek, within 70 yards of the shore.

Directions.—Vessels are prohibited from entering or leaving the port between sunset and sunrise.

Vessels of heavy draught coming from the westward during the South-west monsoon should steer East for Prine Daung, until the flagstaff on Fakír point is in line with Savage island lighthouse, bearing N. 6° W., which leads over the Outer bar in a depth of 25 feet, but, in a vessel of deep draught, Savage island lighthouse bearing N. by W. ⅛ W. will lead over the bar in not less than 28 feet water.

Vessels of light draught, when there is no swell, may cross the Outer bar, in a depth of not less than 16 feet, by passing close to the outer black buoy, and bringing Savage island lighthouse to bear N. by E. ½ E. After crossing the bar the pecked line on the chart

General charts 829, 70.

Plan of Arakan river on 1884. Var. 0° 50′ E.

should be followed, steering first about N.N.W. ¾ W. until Savage island lighthouse bears about East, then altering course to about N.E. ½ N. and N.E. by E. ½ E. until Fakír point bears about N.W., when a course may be shaped between Fakír point and Saunders shoal buoy for the anchorage.

There is a safe passage for boats and small craft between Savage island and the northern end of Baronga island, sheltered from the sea in the South-west monsoon.

Caution.—Entering with the flood stream, great care is necessary when in the vicinity of White rocks, as it sets directly on to them; leaving with the ebb stream, the vessel should be kept as near these rocks as prudence will allow, to prevent being set on to the western bank.

Plan of Akyab on 1884.

Storm signals are shown at Akyab. *See* Chapter I., pages 74-76.

Tides.—It is high water, full and change, at Akyab at 9h. 37m.; springs rise 7¾ feet, neaps 5¼ feet; neaps range 2 feet 8 inches. In the rainy season, April to October, the rise is from 2 to 3 feet more. The tides rise and fall quickly, the slack water lasting 3 hours.

Tidal streams.—The tidal streams are regular, and rapid at springs, when heavy overfalls form on the ebb between Fakír reef and Passage rock. The rate at springs on the Outer bar is from three-quarters of a knot to 2 knots, but between Fakír point and Passage island they attain a rate of from 3 to 4 knots; during neaps the streams are very weak.

The streams set directly across Fakír reef, and a vessel leaving the anchorage when the ebb stream is running will be set towards that reef after passing Fakír point.

Town (*Lat. 20° 8′ N., Long. 92° 53′ E.*).—Akyab town, the head-quarters of Akyab District ranks fourth amongst the towns of the province, and is situated on well-wooded, low-lying ground, in reality an island, triangular in shape, about 5 square miles in extent, and separated from the mainland by a creek which connects the Kaladan and Mayu rivers.

The houses of the Europeans are built near the point which is the apex of the triangle and along the eastern shore of the harbour, while the native town fills the northern part of the triangle; the principal buildings are the Government offices, the jail, the hospital, and the high school, and there are Anglican and Roman Catholic churches. In 1901 the population was 35,680; most of the dwelling-houses are built of wood or mat, with thatched roofs.

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Plan of Akyab on 1884. Var. 0° 50′ E.

Communication.—Steam vessels of the British India line run weekly to Chittagong and Calcutta, and also to Rangoon, Moulmein, and Straits settlements; there is also telegraphic communication.

Coal and supplies.—About 4,000 tons of coal are kept in stock, and between 5,000 and 6,000 tons are imported annually; coaling is carried on with lighters, of which there are about 30 holding from 40 to 60 tons, and from 200 to 400 tons could be put on board in 24 hours.

Provisions, beef, fish, and vegetables, are plentiful. Preserved provisions and marine stores are obtainable. Fresh water of fair quality is supplied, being pumped from a water boat, and a scheme is under consideration for bringing it from a reservoir to be constructed about 2 miles outside the town.

Wharves.—The main iron wharf is 660 feet in length, and its T head 204 feet; it can be reached by vessels drawing 21 feet. There is also a small stone pier and several smaller wooden jetties.

Repairs.—Large repairs can be effected to hull or machinery of vessels; there are two cranes, each lifting 3 tons.

Trade.—The exports consisting almost exclusively of rice, and imports from Burmese ports are gunny bags, dried fish, cotton, betel nuts, &c., but the foreign imports are insignificant. There are eleven steam-power rice mills in the town, a sawmill, and a tannery.

Quarantine.—There are special quarantine regulations at Akyab, a copy of which should be obtained from the Harbour authorities.

Hospitals (*Lat. 20° 8′ N., Long. 92° 53′ E.*).—A large general hospital has 114 beds, and attached to it is a European Seamen's hospital; there is also a dispensary.

Sailors' home.—There is a sailors' home.

Winds and weather.—The South-west monsoon begins early in May, and lasts until the end of October. Occasionally the South-west monsoon increases in strength from a southerly direction, and is accompanied by heavy rain and sea, when caution is necessary in approaching the land.

In the North-east monsoon the wind commences at north in the morning, and hauls gradually to the south-east towards noon; it is then calm until the sea breeze sets in from west and south-west, which veers to north-west in the evening. These winds prevail with regularity from November to April.

Climate.—The town is unhealthy, being subject to regular epidemics of cholera and malarial fever. In the South-west monsoon the rainfall is very heavy, the whole country becoming almost inundated, and the rivers swollen. The winter months are very dry.

Charts 1884, 821.

BARONGA ISLAND, southward of Arakan river entrance, is 17 miles in length north-north-west and south-south-east, three-

General charts 829, 70.

quarters of a mile to 2 miles in width, and generally high and thickly wooded; a hummock is near its southern end; Prine Daung, the tableland at its northern end, is 962 feet high, and conspicuous, except from the southward, where it is hidden by a mountain 1,135 feet high, which latter appears as a sharp peak when seen from the southward, but from the westward is only an inconspicuous serrated ridge.

South Hummock, a hill near the southern end of the island, is conspicuous when seen from the westward, as also is a white pagoda, standing on a low hill on the west coast of the island, 2¾ miles northward of the hummock.

A narrow ledge of rocks, most of them covered at high water, extends from the southern extreme of the island, and at its southern part is a small rock, awash, visible at high water and situated about 6 cables southward of the point; beyond this small rock others, which cover and uncover, extend for a distance of about 2 cables, and there is foul ground for a further distance of about half a mile.

Mud volcano shoal (*Lat. 19° 50′ N., Long. 93° 3′ E.*), with 3¼ fathoms water over it, and surrounded by depths of 15 fathoms, is situated on a bank about a cable in extent, with depths of from 7 to 8 fathoms over it, lying 2¼ miles eastward of South Hummock; the shoal is formed by the probably intermittent action of an active mud volcano. *See* page 82.

Tides.—It is high water at the south end of Baronga island about half an hour earlier than at Akyab, and low water at the same interval; the rise and fall at both places being practically the same.

Peni Kyong, or Middle Baronga, a high, thickly-wooded island, about 24 miles in length in a north-north-west and opposite direction, is eastward of Baronga island and separated from it by Research strait, which is about 2 miles in width at its narrowest part; it is deep at its southern, but blocked by shoals at its northern end, where it joins Akyab port.

A chain of small islands and rocks, of which Square rock (33 feet), Painaisa island (190 feet), Barn island, reddish coloured (100 feet), Conspicuous rock (30 feet), and South rocks, white and flat (12 feet high) are the principal, lies on a narrow ridge; extending about 6 miles in a south-south-east direction from the south point of Peni Kyong island, and a mile from the extreme of the ridge, is Bingham rock, which dries 3 feet, with depths of from 11 to 12 fathoms between; Painaisa island and Conspicuous rock are easily recognised.

Angrei Kyong, or Eastern Baronga, has a line of direction similar to the two outer islands, but is inconspicuous from seaward

Chart 821, Elephant point to Chedúba. Var. 0° 50′ E.

Detached rocks and shoals extend about 5¼ miles south-eastward of its south point, the outermost drying 8 feet.

Communication.—The small steamers which afford communication by the inshore channels usually pass through Mraboong river, calling at Myebon, a town of some importance, but a navigable channel eastward of Angrei Kyong is also used by those running between Akyab and Kyaukpyu.

Small steamers also ply in several of the creeks to the eastward of Hunter and Combermere bays..

KYAUKPYU DISTRICT.—The northern limit of Kyaukpyu district is about 5 miles northward of Myebon, the coastline extending about 65 miles south-eastward and including Ramree and Chedúba islands; the only port is Kyaukpyu. *See* Chapter I., page 42.

Hunter bay, eastward of Angrei Kyong, is a deceptive and unnavigable bay, intersected by several shallow creeks.

Keuain Kaun Taung, 1,610 feet high and situated near the south-west side of an unnamed island, eastward of Hunter bay, is a conspicuous peak which, in clear weather, may be visible from a distance of 45 miles when approaching from the southward.

Kyong Siya (Elizabeth island), 860 feet high, is bold, but has no definite summit; the northern and highest part of the island is the most conspicuous.

Seppings island, which has a conspicuous, conical-shaped summit, 840 feet high, near its north-west side, sloping gradually to the southward and eastward, is a conspicuous mark when approaching Kyaukpyu.

COMBERMERE BAY (*Lat. 19° 36′ N., Long. 93° 30′ E.*) is a considerable inlet, into which flow numerous small straits and rivers, the most important being the An river, which is navigable by boats as far as the town of the same name, situated on the left bank, 23 miles from its mouth. There are depths of 5 to 12 fathoms in Combermere bay, but many islands, shoals, and groups of rocks are scattered over it.

The navigation of the bay, for which the chart is the best guide, is intricate and dangerous, and it is rarely entered by European ships, the trade of the district being carried on by native craft.

Anchorage.—There is temporary open anchorage in from 7 to 9 fathoms water, over mud and good holding ground, off the entrance to Combermere bay.

Plan 831, Kyaukpyu harbour.

Reef island, the north-western of the islands at Kyaukpyu entrance, is about 4 cables in length in a north-east and south-west

General charts 829, 70.

direction, 1½ cables in width, and 190 feet high; it is sparsely wooded, of reddish earth, and not conspicuous from seaward, as it is blended with the higher wooded peaks of the islands eastward of it. It is surrounded by a shore reef which extends 1½ cables from its south-west and north-east sides, and reefs with rocks from 3 to 5 feet high on them extend for 2 miles north-westward of the island; as the locality has not been closely examined the island should not be approached within a distance of 3 miles in that direction.

Wood harbour.—Narkumbau island, three-quarters of a mile eastward of Reef island, is about two-thirds of a mile in length in a north-west and south-east direction, a quarter of a mile in width, and 380 feet high, and forms the northern side of the entrance to Wood harbour; Catherine bluff, the north-west end of Tangaro island, being the southern entrance point. The harbour is nearly a mile in extent, has from 19 to 27 fathoms through its centre, shoaling to its north and south sides.

Anchorage.—Wood harbour affords anchorage in depths of from 5 to 15 fathoms, over mud, with the eastern extreme of Catherine bluff bearing W. ¼ N., and a gap in the hills on Tangaro island about S.W. by W. ¾ W.

Directions.—The entrance to this harbour, between the bluff extremes of Narkumbau and Tangaro islands, should be approached with the north end of Catherine bluff bearing about E. ¼ S. to avoid some irregular soundings extending north-westward of Crooked island.

Tidal streams.—The tidal streams at springs run through Wood harbour entrance at a rate of about 3 knots.

KYAUKPYU HARBOUR (meaning White stone, probably derived from the white pebbly beach) is a well-sheltered anchorage, formed by a chain consisting of Crooked, Quoin, Tangaro, and Laws islands on the north, and the north end of Ramree island on the south; the former extend a considerable distance north-eastward into Combermere bay, with numerous small straits and boat passages between them.

The harbour is open only to the west-north-westward, and the anchorage is well protected by Dalhousie fort point, the northern extreme of Ramree island, from that direction. The eastern portion of the harbour narrows to about 1¼ miles in width at 3 miles eastward of the anchorage, when it abruptly turns south-eastward, forming Fletcher Hayes straits, a broad, safe, and convenient passage for boats, 18 miles in length, and communicating by a smaller creek with Ramree harbour.

Pagoda rock (*Lat. 19° 29' N., Long. 93° 30' E.*), about 2 miles

Plan 831, Kyaukpyu harbour. Var. 0° 50′ E.

south-south-west of Catherine bluff, and on the northern side of Kyaukpyu harbour entrance, is small, 85 feet high, of conical form, with two sharp-pointed summits close together, and is steep-to, but depths under 3 fathoms commence about half a cable eastward of it. Its seaward side is occasionally whitewashed, and it is an excellent mark. The edible-nest swift is found here.

Crooked island, eastward of Pagoda rock, is low, and its western side is skirted by reefs and detached rocks, with depths under 3 fathoms extending nearly 1½ miles; there is foul ground, with a rock 4 feet high and breakers nearly 6 cables north-westward of it. A wooded ridge, about 60 feet high, stretches from the middle of the island for about two-thirds of a mile south-eastward, and on its northern end is a small white pagoda. The eastern and southern parts of the island are low and swampy.

Squadron rocks, low, narrow, and rocky, with a few shrubs and a solitary tree, lie about 1½ cables westward of, and parallel to, the southern part of Crooked island. A rock awash at low water lies 3 cables south-south-eastward of the southern of these rocks, which is 15 feet high.

Quoin island, triangular in shape, thickly wooded, and 260 feet high, lies close south-eastward of Crooked island, and from seaward appears wedge-shaped, the north-western end being the highest part.

A ledge extends nearly 2 cables southward of its south point, from the extremity of which the water abruptly deepens to upwards of 40 fathoms. The space between two prongs, which form the south-east part of the island, is occupied by a flat, which covers at half tide.

North shoal, a small rocky patch of which the western part is awash at low water, spring tides, lies 1$\frac{4}{10}$ miles westward of the southern point of Quoin island.

Buoy.—A can buoy, painted black, is moored about one cable southward of North shoal.

Tangaro island, about 6½ miles in length, is narrow, thickly wooded, of irregular shape, and 50 to 465 feet high; it lies eastward of the above islands, and with them forms the northern side of Kyaukpyu harbour. The space between Quoin island and Barker point, the south-east point of Tangaro island, is filled with a shallow flat, on a great part of which the depths are less than one fathom.

Laws island (*Lat. 19° 27′ N., Long. 93° 36′ E.*), the centre of which is about 1¼ miles southward of Barker point, is about a mile in extent, 590 feet high, covered with foliage, and has a conspicuous tree on its summit, used as a leading mark between the shoals into Kyaukpyu harbour.

General charts 829, 70.

Plan 831, Kyaukpyu harbour. Var. 0° 50′ E.

Southern side.—Saddle island, on the southern side of Kyaukpyu entrance, is three-quarters of a mile in length in a north and south direction, 1½ cables in width, and has two rounded summits sparsely covered with trees near its north end, the northern being 156 feet high; as numerous sunken reefs surround this island, it should not be closely approached.

Shoal water, with several sunken rocks, extends nearly 1¼ miles northward of Saddle island, and two small rocks, 6 and 5 feet high, lie 4 and 7 cables respectively from its northern end.

Foul ground, with the sea breaking on its outer edge, extends nearly 1½ miles westward of Saddle island, and from its southern extreme a reef of rocks above water stretches a mile southward to the northern side of Bowman passage.

Dicey shoal, on which the sea sometimes breaks heavily, is the extreme of the rocks stretching northward from Saddle island.

Buoy.—A conical buoy, painted red, is moored about 3 cables northward of the shoal, extending northward of Saddle island.

Giles bank (*Lat. 19° 23′ N., Long. 93° 26′ E.*), with a depth of 4¾ fathoms over it, is situated in the middle of the harbour entrance, 2$\frac{3}{10}$ miles northward of the north end of Saddle island.

Cap islet, lying 1½ miles south-eastward of the southern end of Saddle island, is 148 feet high, and conspicuous; Knot islet, lying 1⅔ miles eastward of the same end of Saddle island, is 6 feet high, with a few shrubs on it; both islets are surrounded by reefs. The channel between Saddle and Ramree islands is not safe, owing to the numerous reefs and rocky patches in it.

Ramree island.—The northern part of Ramree island is thickly wooded, and forms the southern side of Kyaukpyu harbour. The coast from Adams point, which is abreast Cap islet, trends northward and eastward in a succession of sandy beaches and rocky points, with foul ground and shoal water off it, for a distance of about 3 miles to Georgina point, and thence 2 miles to Dalhousie fort point.

Mount Peter, half a mile eastward of Adams point, is 333 feet high, with a conspicuous tree on the ridge to the northward, and the north-west end of Ladies ridge, which stretches south-eastward for about three-quarters of a mile, and is situated half a mile southward of Georgina point, has on its summit, 218 feet high, some trees, which appear conspicuously from the westward.

Shoal.—A patch on which the depth is 2¼ fathoms, surrounded by depths of from 4 to 5 fathoms, lies 1$\frac{1}{10}$ miles west-north-west of Georgina point.

General charts 829, 70.

Plan 831, Kyaukpyu harbour. Var. 0° 50′ E.

Bombay shoal, a bank of rocky ground, half a mile northward of Georgina point, has depths of from 1¾ to 2¾ fathoms over it, and is generally marked by overfalls. About a quarter of a mile eastward of Bombay shoal is the western end of a patch with depths under 5 fathoms, on which there is a 3-fathoms spot.

Reliance shoal, a small patch with 1½ fathoms water over it and depths of 5 fathoms and less for about a cable southward of it, lies 1¼ miles north-eastward of Georgina point.

Buoy.—A conical buoy, painted red and surmounted by a basket topmark, is moored 1½ cables northward of Reliance shoal.

Dalhousie fort point, well marked by high trees on it, is low and sandy, with a large clump of palm trees and the remains of a fort on it; at 1¼ cables south-eastward of the point is an iron pier. The sea is rapidly encroaching on the land westward of Dalhousie fort point.

From Dalhousie fort point a sandy beach, with a foreshore of mud, which dries out from 1½ to 2 cables at low water, trends south-eastward for 1¾ miles to the mouth of Ungyaung creek.

Chart 821, Elephant point to Chedúba strait.

THE TERRIBLES, about 9 miles westward of Saddle island, are three groups of rocks above water, extending, with the surrounding sunken rocks, nearly 8 miles in a north-north-east and south-south-west direction.

North Terrible (*Lat. 19° 27′ N., Long. 93° 18′ E.*), the largest rock of the group, is 12 feet high, and sunken rocks extend 2 miles northward from it, and a similar distance in a west-south-west direction.

Mid Terrible, 1¼ miles south-south-westward of North Terrible, is 14 feet high.

South Terrible, 12 feet high and consisting of several low rocks, is 4 miles south-south-west of North Terrible; breakers extend nearly 2 miles southward of it, South rock, which dries 6 feet, being near the south extreme. There is a large reef between Mid Terrible and South Terrible.

Mud volcano shoal.—A shoal, with 4¼ fathoms water over it, formed by an active mud volcano, and situated 3 miles west-south-west of Mid Terrible, was found during the course of the survey in 1908; its position when close to is pointed out by discoloured water, but as this shoal area may have increased, or other shoals may exist, this locality should be avoided. Also in September, 1909, a volcanic upheaval took place about 6 miles south-eastward of Mid Terrible, in the southern approach to the channels inside those islands, rendering great caution necessary. *See* page 82.

General charts 829, 70.

Chart 821, Elephant point to Chedúba strait. Var. 0° 50′ E.

CAUTION.—The Terribles should not be approached nearer than a depth of 20 fathoms to the southward, or 24 fathoms to the westward, unless bound for Kyaukpyu harbour or Chedúba strait; and a wide berth should be given them at night.

Irrawaddy rock, which dries 2 feet, is situated at the south-west edge of a shoal one mile in length, in a north-east and south-west direction within the 5-fathoms contour line surrounding it; the rock lies $3\frac{9}{10}$ miles westward of the summit of Saddle island; and is not easily seen in a smooth sea.

Plan 831, Kyaukpyu harbour.

Directions.—The entrance to Kyaukpyu harbour is well marked by natural objects, and the principal dangers near the track in are buoyed, but it should be remembered that at the entrance the flood stream sets to the northward, and the ebb to the southward, often with considerable velocity.

From the north-westward or westward approach with Pagoda rock bearing East, until Saddle island bears S.E., and then steer to enter the harbour with the tree on the summit of Laws island bearing S. 83° E. (*View on 1884*), which passes about 4 cables southward of Giles bank and North shoal black buoy; the same distance northward of Dicey shoal, and 2 cables northward of the red buoy marking Reliance shoal, after passing which, round Dalhousie fort point to the anchorage.

Pagoda rock (*Lat. 19° 29′ N., Long. 93° 30′ E.*) should not be brought to bear northward of East until North Terrible bears westward of S.S.W. ¾ W.

From the southward, to pass eastward of the Terribles, Nondogi island summit, which is high, conspicuous, and wedge-shaped, should be kept in line with the northern point of Satellite island, bearing about N. 28° E., until South Terrible bears N.W., when alter course to North to pass about 2 miles westward of Irrawaddy rock, until Nondogi summit is well open westward of Satellite island, about N.E. ½ N., which course may be steered until the single tree on Laws island bears S. 83° E.

The passage inside the Terribles should not be taken in a sailing vessel.

Or a vessel with local knowledge might pass through Dickenson channel, between Irrawaddy rock and the dangers westward of Saddle island, by keeping Seppings peak in line with the centre of Satellite island, bearing N. 32° E.

Note.—The positions of the buoys at Kyaukpyu cannot be relied on.

General charts 829, 70.

Plan 831, Kyaukpyu harbour. Var. 0° 50′ E.

Anchorage.—The best anchorage is south-eastward of Dalhousie fort point, in depths of from 9 to 10 fathoms, over mud, with the pier bearing between West and W. by N. ½ N., distant half a mile. There are strong eddies at this anchorage at springs, but the tidal streams are weak at neaps.

There is also anchorage in Southampton road, eastward of Dicey shoal, but the holding ground, consisting of broken shells and stones, is not good.

Tides.—It is high water, full and change, at Kyaukpyu pier, at 9h. 38m.; springs rise 10½ feet, neaps rise 6½ feet, neaps range 2 feet 6 inches.

Tidal streams.—The rate of the tidal stream varies from one knot to 3 knots an hour; outside Saddle island the flood sets northward, the ebb southward, frequently with considerable velocity, but the streams are very weak at neaps. Amongst the islands the streams follow the direction of the channels.

Currents.—In the offing the drift of the North-east and South-west monsoons will be experienced.

Kyaukpyu town (*Lat. 19° 26′ N., Long. 93° 33′ E.*), the headquarters of the district of the same name, is built close to the sea shore, on a sandy plain, in the northern angle of Ramree island, and bounded on the south-west by a low range of sandstone hills; the name, signifying white stone, is said to be derived from the white pebbly beach fronting it. In 1901 the population was 3,145.

Communication.—British India Steam Navigation Company's vessels to Calcutta and Rangoon call weekly. Small steam vessels ply through the Wembaik creek to Ramree, Taungup, and Chedúba, and those belonging to the Arakan Company have a weekly service between Kyaukpyu and Akyab, proceeding through the creeks, and calling at any important villages; these vessels also run to Ramree and Sandoway. Telegrams are sent to Akyab, Rangoon, and Taungup for transmission.

From Kyaukpyu southward to Sandoway river the coast is indented by numerous creeks, navigable by large country boats which go almost the whole way from Kyaukpyu to Taungup by backwater, the passage taking about four days. The boats are not built for sea work, and the natives are unable to land from a boat in the surf.

Supplies of any kind are scarce; a few fowls, ducks, and vegetables, and occasionally beef of inferior quality, may be procured.

Good water is obtainable from wells.

Trade.—The exports go entirely to Burmese ports, from which three-fourths of the imports come, and the remainder from Calcutta.

General charts 829, 70.

Chart 821, Elephant point to Chedúba strait. Var. 0° 50′ E.

RAMREE ISLAND is 44 miles in length in a north-west and south-east direction, and nearly 19 miles in greatest breadth; its highest summit, situated near the south-west side, is 1,130 feet.

West coast.—The west coast of Ramree from Adams point trends south-westward 2 miles to West point, whence it turns south-eastward to Thames point, and is tolerably straight, of rocky appearance, with a few detached rocks above water near it. This coast rises somewhat steeply to a range of high hills, the most prominent peaks of which are Outer peak, North Paps hill, and Tree summit.

Outer peak, at the northern end of a range of hills close to the coast, is 420 feet high and comparatively bare, although the range to the southward, which rises to 540 feet, is thickly wooded.

North Paps, nearly 5 miles southward of Outer peak, and the most remarkable hill on this stretch of coast, is 455 feet high, and has a conspicuous bungalow on the coast at its foot, near Minbyin village.

Brown hill, nearly 5 miles southward of North Paps, is so named on account of its colour, as compared with other hills in the vicinity, and south-eastward of it is Tree summit, 420 feet high, and easily recognised by a tall tree on it. Black hill, 410 feet, and Pimple hill, 465 feet high, are both back hills, named from their appearance as seen from seaward; they are unmistakable when not obscured by the front range.

Caution.—As there are several off-lying dangers along this coast, it should be given a wide berth.

Research rock is a sunken reef, with a depth of less than one fathom in its centre, and extending in patches in a north-west and south-east direction to a total length of 1¾ miles; it lies 2¾ miles south-south-west of West point.

Chart 832, Chedúba strait and Ramree harbour.

Thames point, 15 miles south-eastward of West point, is low, and has some tall trees on it. The bight formed between Thames and Rocky points has depths of 4 fathoms at the distance of 2½ miles from the shore.

CHEDÚBA STRAIT, between Ramree and Chedúba islands, is 5 to 6 miles wide, and has numerous shoals in it; the navigable channel has a depth of 3½ fathoms at low water springs.

Rocky point (*Lat. 19° 0′ N., Long. 93° 40′ E.*), 10 miles south-eastward of Thames point and the north-western entrance point of Chedúba strait, is low, but a table mountain north-north-eastward of it is conspicuous from the north-west.

General charts 822, 829, 70.

Chart 832, Chedúba strait and Ramree harbour. Var. 0° 50′ E.

Beacon.—A pole beacon, 30 feet high, and surmounted by a basket, marks Rocky point.

Coast.—From Rocky point to a point about 4 miles south-eastward the coast forms a deep bight, at the head of which is Dark hill, 268 feet high; Helby hummock, small, wooded, and showing up well from the north-westward, is nearly a mile south of Dark hill. (*View on 832.*)

From the point on the south-east side of the bight the coast trends in an east-south-east direction for 5 miles to where Button islet, 115 feet high, lies about a quarter of a mile off the land; this islet is not noticeable from the westward.

Beacon.—A pole beacon, 30 feet high and painted white, stands on the unnamed point above mentioned.

Coast.—From Button islet the coast trends 8½ miles in a south-east direction to the southern point of Ramree island; the highest summit of the island, 1,130 feet high, is 1⅝ miles eastward of Button islet.

Shoal water extends off the south coast of Ramree island for distances of about 1¼ miles southward of Rocky point to a quarter of a mile off Button islet, whence to the southern point of Ramree island it fringes the coast at distances of from a quarter to two-thirds of a mile, and has several rocks on it.

Buoy.—A conical buoy, painted red, is moored on the edge of the shoal about 3 miles south-eastward of Rocky point.

Shoals.—A patch with a depth of 3 fathoms over it lies 3 miles south-south-west of Rocky point, and is the westernmost patch of a line of shoals trending east-south-eastward for nearly 5 miles; the least water on these patches is 1¼ fathoms.

These shoals narrow both the northern and southern channels of the strait to a width of about half a mile.

CHEDÚBA ISLAND, situated southward of Ramree island, is 16 miles long in a north-north-west and opposite direction, and triangular in shape, its northern coast having an east and west direction; it is well wooded, with a considerable amount of undulating country, and some hills rise to a height of nearly 900 feet. Its northern coast is low, the western and southern coasts are high, and the eastern coast is flat.

Centre peak (*Lat. 18° 48′ N., Long. 93° 37′ E.*), 7 miles southward of Searle point, the north extreme of the island, is 819 feet high,

General charts 822, 829, 70.

Chart 832, Chedúba strait and Ramree harbour. Var. 0° 50′ E.

and conspicuous. Pagoda peak, 725 feet high, and 2 miles further south, has two small pagodas, with a single tree between them, on its summit. Palangutaung, or South peak, three-quarters of a mile from its southern coast, rises to a height of 885 feet. The greater part of the island is cultivated, and covered with foliage.

An active mud volcano, which discharges inflammable gas, exists a short distance north-westward of Palangutaung; an eruption from it was seen in 1884. There is another near the north-west point.

Population.—In 1901 the population was 26,899.

North coast.—From the north-western point of Chedúba island, which is low and has an extinct mud volcano upon it, the coast trends east-north-eastward 8 miles to Searle point, and thence in a slight sweep east-south-eastward for a similar distance to Sandy point, which is low.

Shoal water extends off all the north coast, and westward of Searle point it stretches for 10½ miles in a westerly direction, with Beacon islet near its extreme, and rocks and shoals between, and then in a south-east direction towards the north-west point of the island, forming a triangular area of foul ground, covered with large boulders, some of which are above water.

Anchorage.—If desiring to anchor in this vicinity, there is excellent holding ground 1¾ miles N.E. by N., of Beacon islet, or off Searle point, north of the island.

Tides.—It is high water, full and change, at Searle point at 9h. 15m.; springs rise 10 feet, neaps 7 feet.

Beacon islet, 4 cables long in an east and west direction, 30 feet high, and composed of stones, lies 9¼ miles westward of Searle point. A rock, having three heads close together, awash at high water, lies 8 cables west-north-west of Beacon islet, and is the outer danger.

LIGHT.—On Beacon islet an iron tower, painted red, exhibits at an elevation of 122 feet above high water, a *white group flashing* light, showing groups of *two* flashes *every ten seconds*, and should be visible, in clear weather, from a distance of 17 miles.

Beacon.—A small stone beacon, 17 feet high and painted white, stands on the highest part of Beacon islet.

Rocks.—A rock, with a depth of 4 fathoms over it, which breaks in heavy weather, lies 7¾ miles north-westward, and another with 5 fathoms water over it, also breaking in heavy weather, is situated 5¾ miles in the same direction, from Beacon islet lighthouse.

General charts 822, 829, 70.

Chart 832, Chedúba strait and Ramree harbour. Var. 0° 50′ E.

Mud volcano shoal.—As the result of an eruption of a mud volcano in 1906, an island was thrown up, which, in 1907, was 19 feet above high water; it has now been complefely washed away, but a shoal, with a depth of 2¼ fathoms over it, which breaks, and is the least water on a bank two-thirds of a mile in length in a north and south direction, and half a mile in width, within the 5-fathoms contour line, remains near its position, and 4$\frac{8}{10}$ miles north-westward of Beacon islet lighthouse. Mariners should avoid the locality of the above shoals. *See* page 82.

Henry rocks (*Lat. 18° 51′ N., Long. 93° 26′ E.*) is a group of rocks, above and below water, one being a pinnacle 17 feet high, lying on a reef 1½ miles in length in a north-east and south-west direction, with two rocks, 4 feet high, near its south-west extreme, which are 3 miles west-south-west of the north-west point of Chedúba island.

South-west coast.—The south-west coast of Chedúba island is bold, and trends in a south-east direction for 15 miles, faced by numerous detached rocks, both above water and sunken; native craft, with local knowledge, frequent it during the North-west monsoon for rice. West hill, 695 feet high, and wooded, is nearly 7 miles south-eastward of the north-west point of the island.

The only indentation on this side of Chedúba island is at its south-western end, immediately westward of Palangutaung, where Pyramid bay, so named from Pyramid rock, a pinnacle 208 feet high, lying off it, affords good anchorage to native craft during the North-east monsoon; South of Pyramid rock is a reef that extends off the south end of the island for about 2 miles.

The outer rock on this coast is awash at low water, and situated 1¼ miles off the land west-south-west of West hummock, which is westward of West hill.

Depths off-shore.—The 10-fathoms contour line, which is 2½ miles westward of Beacon islet lighthouse, passes close westward of the two 4-feet high rocks, and then gradually closes the south-west coast of Chedúba island, from which it is generally distant about one mile.

Tidal streams.—The tidal streams on the south-western side of Chedúba island follow the general trend of the land, but there is a considerable indraught between Chedúba and Flatt islands. The North-east monsoon, though not affecting the regularity of the land and sea breezes, appears to cause a set to the southward.

East coast.—The east coast of Chedúba island, trending southward from Sandy point, is low and thickly wooded for 8 miles, when it becomes high. Chedúba creek, leading to Chedúba town, is 2 miles

General charts 822, 829, 70.

southward of Sandy point, and a pagoda, situated about 6 cables north-westward of the entrance, which is newly whitewashed every autumn, is at that time conspicuous.

The shallow ground extending from the east side of Chedúba island is prolonged in a south-east direction for upwards of 7 miles from the south-eastern extremity of the island, and has three islands and several rocks on it.

Chedúba town (*Lat. 18° 51′ N., Long. 93° 43′ E.*) is about three-quarters of a mile within Chedúba creek, and in 1901 had a population of 1,540. The produce of the island, which is chiefly rice and tobacco, is taken from the town by native craft to Kyaukpyu and Akyab for export.

Supplies.—Cattle, poultry, fruit, and wood can be obtained at reasonable prices, but water is scarce during the dry season.

Tokwekwong or Round island, 3½ miles off the east coast of Chedúba island and 9½ miles southward of Sandy point, is one mile long, with an even rounded summit, 290 feet high.

Bank.—The edge of the bank, with depths under 3 fathoms, which is 1½ miles eastward of Sandy point, has a south-south-east direction, increasing its distance from the east coast of Chedúba island, and passes about half a mile eastward of Tokwekwong island.

Middle ground, a bank with depths of 2¼ to 3 fathoms over it, occupying about two-thirds of the channel on the eastern side between Sandy point and the southern point of Ramree island, extends about 7 miles in an east and west direction, and 6 miles north and south.

Between the western side of the bank and the edge of that extending from Sandy point the channel is a mile in width, with a depth of 3½ fathoms, and between the eastern side of Middle bank and the western side of the south point of Ramree island, the channel has a width of 3 cables, with a least depth of 3¼ fathoms.

Flatt island, the northern point of which is nearly 3 miles south-south-west of Tokwekwong island, is 4 miles in length in a north and south direction, and generally low, but rises in the centre to a height of 105 feet.

Hill island, three-quarters of a mile southward of Flatt island, is 80 feet high, and from its south end foul ground, on which is South rock, 8 feet high, lying half a mile southward of the island, extends for nearly one mile in a south-south-west direction, and is steep-to.

The channel between Flatt island and Chedúba is foul, and numerous reefs extend between and amongst Tokwekwong, Flatt, and Hill islands; the 3-fathoms contour line of the bank which fronts Sandy point, passes close eastward of Tokwekwong, and is 2½ miles eastward of the northern part of Flatt island. Hill island should not be approached on its southern and western sides nearer than 1½ miles.

North-west entrance.—Depths.—Following the track recommended, shown by a pecked line on the chart, the depth at the entrance, 5 miles westward of Rocky point, should be 4½ fathoms, deepening to 5 fathoms, which depth may continue to the turning point in the channel, but the track passes close to a 4½-fathoms patch south-eastward of the red buoy. (Page 354.)

On the course to the southward, between the bank off the east coast of Chedúba and Middle ground, the least depth should be 3½ fathoms.

Directions.—From the north-westward.—Approaching Chedúba strait from the north-westward, Chedúba hills will be seen to the south-eastward; Centre peak being the most conspicuous and isolated, with Pagoda peak immediately westward of it. The high hills of Ramree island, on the north side of the strait, are further eastward, and fall somewhat abruptly, their summit being marked by a slight hump.

Helby hummock (*Lat. 19° 0′ N., Long. 93° 44′ E.*), in the same direction, with Dark hill, a moderate sized wooded hill, northward of it, are both over the low ground of Rocky point.

From a position about 5 miles westward of Rocky point, with the highest summit of Ramree hills bearing E. by S., and Centre peak S. by E., steer about E. by S. ⅝ S. on the track recommended, marked by a pecked line on the chart, towards the dome-shaped hill, 285 feet high, which marks the southern extreme of the range, and is close to the coast 4½ miles north-westward of the southern point of Ramree island, and pass about half a mile southward of the red buoy marking the edge of the bank off the southern coast of Ramree island, about 3 miles south-eastward of Rocky point, but which must not be depended on, as it is liable to be washed away.

Continue this course with the dome-shaped hill ahead until Bare hill, a blunt conical hill to the northward, is open westward of Dark hill, the wooded hill behind Helby hummock, bearing N. 23° W. (*View on 832*), which mark on astern, and following the pecked line, steering S. 23° E., leads southward in the channel between the shoal water off Sandy point and Middle ground, into Ramree road.

As the edge of the bank on Chedúba island side is very steep in places, preference should be given in this latter channel to the Middle ground side, that shoal being cleared when Tokwekwong island bears S.S.W.

From the southward.—From a position with Tokwekwong island bearing West, distant 1½ miles, steer N. 23° W., when Bare hill, the blunt conical hill, open westward of Dark hill, the leading mark between Middle ground and the shoals off Chedúba island, will be just visible above the horizon and shows as a double hill. When the dome-shaped hill bears E. by S. ⅝ S., steer W. by N. ⅝ N., keeping it astern, and passing southward of the red buoy, follow the track recommended until about 5 miles westward of Rocky point.

RAMREE HARBOUR.—Sagu island is separated from the south point of Ramree island by The Gates, a channel 1¼ miles in width, and with depths of from 18 to 36 fathoms, which is the main entrance into Ramree harbour. From this entrance the harbour trends northward for 18 miles, with an everage breadth of 3½ miles, forming an arm of water separating Ramree island from the low swampy islands adjacent to the mainland. There is excellent anchorage all over Ramree harbour, but it contains several rocks and shoals.

The entrance to the harbour eastward of Sagu island is filled with mud and sand banks, through which there are some narrow channels, only suitable for fishing boats.

Sagu island (*Lat. 19° 48′ N., Long. 93° 58′ E.*), nearly 4 miles in length in a north-west and south-east direction, and 2½ miles in breadth, has Channel clump, a conspicuous isolated clump of trees, 195 feet high, on its northern part, which is a mark for the Gates from the south-westward.

Dragon shoal, of varying depth, and with rocks and shoal patches throughout its length, trends for 5¼ miles in a north-north-east direction from the northern point of Sagu island. White rock, 3 feet high and one of a group above water, lies about a mile from its northern end.

On the western side of the channel some rocky patches with depths of from 2¾ to 3¼ fathoms over them, extend in an easterly direction for a mile from a point of Ramree island, 1⅔ miles north-eastward of its south point, leaving a channel about three-quarters of a mile wide, with depths of from 5¾ to 9 fathoms between them and the western edge of Dragon shoal. There are numerous fishing stakes in this part of the channel.

Flat reef, a patch of rock, covered at high water, and steep-to, lies midway between the northern end of Dragon shoal and the coast of Ramree island to the north-west. It may be passed on either side, but the channel between it and the north end of Dragon shoal is 4 cables in width, and that generally used.

Beacon.—A beacon consisting of a mound of stone of white colour, about 15 feet in height, is on the southern end of Flat reef, marking it when covered at high water.

Chart 832, Chedúba strait and Ramree harbour. Var. 0° 50′ E.

Kyang-yaung point, 100 feet high, is a bluff on the western shore, 8 miles north-north-west of the south point of Ramree island, with a low islet half a mile south-eastward of it, which is steep-to on its eastern side; a shoal, nearly awash at low water, spring tides, lies one-third of a mile north-eastward of the northern part of the point.

Oyster reef, which covers at high water, spring tides, lies 3 miles northward of Kyang-yaung point, and Cutters rock is a mile farther in the same direction. For 5 miles northward of Cutters rock there are depths of 3¼ to 4 fathoms, but the channel is much narrowed by mudbanks.

Ramree river entrance, 8 miles northward of Kyang-yaung point, admits vessels of 9 feet draught, which can navigate the river to within 1½ miles of Ramree town at ordinary high water.

Ramree town, about 5 miles up Ramree river, had a population of 2,540, in 1901, and carries on a small trade with Chittagong, Sandoway, and Bassein.

Wembaik creek, which joins the north-western part of the harbour and the inner part of Kyaukpyu, can be navigated by steamers of from 6 to 8 feet draught.

Magyigyun (*Lat. 18° 44′ N., Long. 94° 0′ E.*), an island 2¼ miles in length in a north-west and south-east direction, lies 2 miles southward of Sagu island; it is 270 feet high, whale-backed, and stands in the centre of a shoal bank, 5 miles long.

Tangagyochaung, a small islet, lies about half a mile off its west point, and the western end of the shoal bank is 1¼ miles westward of the islet. Nyaungbinchaung islet lies half a mile south-west of a point on that side of the centre of Magyigyun island, and marks the south-western edge of the shoal bank.

Osprey rocks, 8 feet high, form a group lying on a shoal, 1¼ miles in length in a north-north-east and opposite direction, and half a mile in width, situated 5 miles south-eastward of the south-east point of Magyigyun.

Pandaw rocks, a group of low rocks, the north-westernmost 2 feet high, lie on a shoal three-quarters of a mile in extent about 3½ miles east-north-east of Osprey rocks.

Gungasager rocks, 3 feet high, lie 10 miles south-eastward of the south-east point of Magyigyun, and are on the south-west steep-to end of a shoal, which, within the 5-fathoms contour line, is 1¾ miles in length in a north-east and opposite direction; a patch of foul ground, half a mile in length in an east and west direction and with depths of from 3¾ to 4¼ fathoms, lies 1¾ miles northward of Gungasager rocks.

General charts 822, 829, 70.

Chart 832, Chedúba strait and Ramree harbour. Var. 0° 50′ E.

Anchorage in Ramree harbour may be obtained in depths of from 3½ to 4 fathoms, with the entrance to Ramree river bearing about W. ½ N.

Directions.—Approaching Ramree harbour from the south-eastward, pass south-westward of Gungasager and Osprey rocks at distances of about 2 and 2½ miles, respectively, and from 2½ to 4 miles westward of Magyigyun island, whence steer to the northward for the entrance to the Gates, avoiding the fishing stakes, which are charted, in this channel, and proceed through the Gates in mid-channel, steering about N.E. ¾ E.

When the north point of Sagu island bears S.S.E. ¾ E., alter course to N. by E. ¼ E., passing eastward of the shoals extending into the harbour from the coast of Ramree island, observing that numerous fishing stakes are charted here, and not bringing the north point of Sagu to bear westward of S. ¼ W., until about a mile from Flat reef beacon, when alter course to pass 2 cables south-eastward of Flat reef.

Having passed Flat reef steer to pass half a mile eastward of Low islet off Kyang-yaung point, when a N. by W. ½ W. course leads eastward of Oyster reef and Cutters rock, whence keep about three-quarters of a mile off the western shore to the anchorage off Ramree river entrance.

Caution is necessary in the vicinity of Flat reef, Oyster reef, and Cutters rock.

Tides.—It is high water, full and change, at Sagu island at 9h. 23m.; springs rise 11 feet, neaps rise 8 feet.

At Flatt island it is high water at 9h. 7m.; springs rise 9 feet, neaps rise 6½ feet; neaps range 3½ feet.

At the south entrance to Wembaik creek it is high water at 9h. 50m.; springs rise 12½ feet, neaps rise 9 feet.

Tidal streams.—The flood stream sets northward, and the ebb southward, at springs, with a rate in the harbour of 3 knots, and in the Gates of 3 to 4 knots, in the direction of the channel.

KAYAING CREEK (*Lat. 18° 45′ N., Long. 94° 8′ E.*) entrance is about 11 miles south-eastward of the northern point of Sagu island; Taungup river, on which is the village of that name, flows into the narrow creek, and within a mile of Taungup the river is about 50 feet wide, and barely navigable by a steam launch.

Coast.—From Kayaing creek entrance the coast trends south-south-eastward for about 13½ miles to the south-west point of Singaung island, on the northern side of Sandoway river entrance. This land forms long low islands, rising at about 25 miles within them to the mountains of Kyaukpyu range.

General charts 822, 829, 70.

Chart 832, Chedúba strait and Ramree harbour. Var: 0° 50′ E.

SANDOWAY DISTRICT commences on the mainland side northward of Ramree harbour, and the coastline extends southward for about 115 miles; Sandoway and Gwa are the two ports. *See* Chapter I., page 43.

HEYWOOD CHANNEL.—About 4 miles south-eastward of Flatt and Hill islands, is a line of reefs and rocks, about 5½ miles in length in a north-north-east and south-south-west direction, which, with West shoal, detached, and lying about 2½ miles south-westward form the eastern side of Heywood channel, the western side being the reefs and shoals extending from Flatt and Hill islands; this channel, about 2½ miles in width at its northern end, reduced to about 8 cables between the 5-fathoms contour lines, has depths of from 5¼ to 12 fathoms, but it is not recommended.

West shoal, about 5 miles south-south-east of Hill island, is a quarter of a mile across, and does not always break; at low water the rocks are visible between the rollers, and there are depths of 12 and 14 fathoms close around it. Hill island bearing northward of N.N.W. leads westward of it.

Sail rock, 2⅔ miles north-eastward of West shoal, is 8 feet high. The extreme of the shoal on which it stands is half a mile southward of the rock, with a rock awash near its edge, and there are depths of from 5 to 8 fathoms half a mile eastward and westward of Sail rock.

False rock (*Lat. 18° 37′ N., Long. 93° 53′ E.*), 4¾ miles north-north-east of Sail rock, is a solitary rock 10 feet high, joined to Sail rock by the chain of shoals and reefs already mentioned. There are depths of 8 fathoms half a mile eastward of it, and the extreme of the shoal on which it stands is one mile north-north-west of it.

There is no safe passage between Sail and False rocks.

Unguan or Tree island, 11 miles south-eastward of Hill island, is three-quarters of a mile long in a north and south direction, 130 feet high, and has a dense clump of trees on its summit. A reef of rocks extends one mile south-eastward of its south point, the whole of the eastern side is foul to a distance of nearly a mile, and foul ground three-quarters of a mile north-eastward of its north point; a patch with a depth of 4 fathoms over it is reported at two-thirds of a mile north-westward of that end of the island.

Shoals.—Three patches lie on a south-west line from the north point of Unguan island, the outer, about 3 miles distant, having a depth of 7 fathoms over it; a 6½-fathoms rocky patch is situated 4¾ miles south-south-west of the island.

General charts 822, 829, 70.

Chart 832, Chedúba strait and Ramree harbour. Var. 0° 50′ E.

Cutters patch, a small shoal, on which the least depth is 2¼ fathoms, over rocky bottom, lies about 2 miles north-north-west from Unguan island.

East reef, 4½ miles north-north-east of Unguan island, is nearly a mile long in a north and south direction, and half a mile wide; it dries at half tide, and has 5½ to 7 fathoms around it, except north-eastward, where shoaler water extends three-quarters of a mile.

Childers channel, between West shoal and the shoal on which are Sail and False rocks, on the west, and Cutters patch and East reef on the east, is nearly 4 miles in width, with depths of 9 to 15 fathoms; when West shoal is breaking this channel is a good one.

Directions.—To proceed through Childers channel, West shoal should be rounded at the distance of a mile, and a N.E. ½ E. course steered, which will lead 2 miles north-westward of East reef.

Nerbudda shoal, 6 miles in length in a north-east and south-west direction, within the 10-fathoms contour lines, is a bank with a general depth of 6 to 10 fathoms, but there are several shoal heads upon it.

Near the north-western edge, and 4 miles south-eastward of the south point of Unguan island, is a shoal with a depth of 1½ fathoms over it, and 1½ miles southward of this, for about that distance across the centre of the shoal, are several patches, the shoalest having 3 fathoms water over it.

At the south-west end of the shoal, and about 5½ miles south-south-east of Unguan island, is a mud volcano, which was in a violent state of eruption in April, 1908, when it was seen from the shore, a distance of 25 miles; it is now about 3 cables in extent, one foot above water, and the sea breaks over it. It is not considered probable that this formation will remain visible at high water for any length of time.

Chart 822, Chedúba strait to Koronge island.

A patch, with a least depth of 8 fathoms over a coral bottom, is situated 2$\frac{8}{10}$ miles south-westward of the mud volcano. *See* page 82.

Chart 832.

The channel between Unguan island and Nerbudda shoal is 3 miles wide, has general depths of 11 to 14 fathoms, and is much used owing to its being well marked by Unguan island.

Unguan island bearing northward of N. by W. leads westward of the mud volcano on Nerbudda shoal, and from a position 3 miles southward of Unguan island, a N.E. course leads through in mid-channel.

Tidal streams.—The tidal streams on the Arakan coast set northward during the flood, southward during the ebb, and are much influenced by the immense tidal tracts of backwater. Local indraughts are strong during the north-going stream, but the outset is small with the south-going stream. There are no rapid tidal streams between Kyaukpyu and Sandoway, except at Ramree harbour entrance, *see* page 361.

COAST.—Sandoway, also known as Thandwe (Iron bound), is a mountainous district, the Arakan Yoma range sending spurs which reach to the coast, these again throwing out a number of side spurs parallel to the main range. Southward of Sandoway river the coast is rugged with few places of shelter. The rivers draining the country are but mountain torrents to within a few miles of the sea.

Sandoway river (*Lat. 18° 33′ N., Long. 94° 13′ E.*) flows into the sea southward of Singaung island, from the south end of which a dry sand spit and shoal water extends to Drunken Sailor rock; a rest house stands on the southern end of Singaung island. Sandoway town is about 15 miles up the river, which rises in the hills to the south-eastward.

The river is navigable by large boats; and by small steamers at ordinary high water to the town, above which for a short distance the river is tidal; steamers of from 6 to 8 feet draught can ascend to about 4 miles below the town.

Landing.—When the wind is westward of north, a heavy surf breaks along the coast making landing in boats hazardous.

Drunken Sailor Rock, 2 miles westward of the south-west point of Singaung island, is a patch, 6 cables in length, in a north-west and south-east direction, its shoalest portion nearly drying at low water, when there is generally a break on it.

Zalattaung island, on the southern side of Sandoway river entrance, is 180 feet high, and about 8 cables in length, in a north-west and south-east direction. Rocks and foul ground extend about three-quarters of a mile south-south-westward of its western end, and from the extreme of this foul ground there are soundings of 4 and 5 fathoms for 6 cables south-westward.

Singyat island, the sea coast of which is a mile in length, lies south-eastward of Zalattaung island, separated from it by a narrow channel filled with rocks.

Gwataung, 610 feet high, south-eastward of Singyat, is a good landmark, and is the only hill of any considerable elevation on this coast.

Zalattaung, Singyat, and Gwataung, appear like three islands from the southward and westward, but from the north-westward the three seem one island.

Anchorage (*Lat. 18° 33′ N., Long. 94° 13′ E.*).—There is anchorage in a depth of about 6 fathoms, over mud, northward of Drunken Sailor rock, with the rest house, bearing S.E. by E. ⅜ E., and a remarkable tufted clump of trees, 145 feet high, on Singaung island, 2 miles farther north, E. by N. ¾ N.

Steam vessels of the B. I. Company find good anchorage southward of Drunken Sailor rock, in the North-east monsoon, but in the South-west monsoon it is exposed and dangerous. In the South-west monsoon the port is considered closed.

Directions.—Steer about E. ⅞ N. for the rest house, which should lead southward of Drunken Sailor rock, and when Zalattaung bears South haul to the southward to round the sand spit off Singaung.

A steam launch drawing 3 feet can ascend the river to Sandoway with the flood; reaching Kinmaw, a large village, at nearly low water, whence a road leads to the town, a distance of 5 miles.

Tides.—It is high water, full and change, at Singaung island at the mouth of Sandoway river at 9h. 14m.; springs rise 9 feet, and neaps 6½ feet; neaps range 3½ feet.

Sandoway town, the head-quarters of the District, is situated on the left bank of the river, 15 miles from its mouth and from 4 to 5 miles from the coast; it lies in a hollow surrounded by hills, the native town being backed by one on which stands the civil station occupied by the European officials. In 1901 the population was 2,845.

Communication.—Steam vessels of the British India Steam Navigation Company from Calcutta and Rangoon call weekly off Sandoway river entrance, except during the South-west monsoon, when the mails are brought from Kyaukpyu viâ Taungup, by back-water. A steam launch maintains communication between the road-stead and the town.

Trade consists chiefly in the export to Akyab and Kyaukpyu of rice, tobacco, sessamum, plantains, betel leaf, salt (made by boiling, and partly by solar evaporation), salt fish, fish-paste, dhaní leaves for thatching, and boat building.

The import trade consists of piece goods, twist, betel-nut, crockery, hardware, and various articles for domestic use.

Climate.—Three seasons follow each other with regularity, but with occasional variation in duration, and time of commencement.

The cold season from November to February, when the dew is exceedingly heavy and the nights are chilly, the winds light, usually at first from north-west and north-east, gradually veering to west and east. From February to May there are dense fogs during the evenings and mornings, and the wind is westerly.

Towards the middle of May, thunderstorms, with lightning, squally weather, and south-east and south-west winds usher in the rainy or warm season, which ends about October, with still more violent atmospheric disturbances and strong winds from south and south-west, gradually becoming variable, till, toward the end of October they settle and the cold weather begins.

Chart 822, Chedúba strait to Koronge island.

COAST.—From Gwataung the coast is low and sandy, and trends about 9 miles in a south-south-east direction to Apau ye, a bluff islet with a bay to the northward of it, which is foul; about 2 miles south-eastward of Apau ye islet is the northern entrance point to Andrew bay.

Andrew bay (*Lat. 18° 20′ N., Long. 94° 21′ E.*) is about 3 miles in extent, its central part, about half that area, being clear of dangers, with good holding ground. Money point, on the southern side of the entrance, is a small peninsula, the summit of which, 395 feet high, with detached trees on it, forms a conspicuous mark easily recognised from seaward.

Sandoway bay, immediately eastward of the northern entrance point, is small, and has a small stone landing jetty, from which a road leads to Sandoway, a distance of 10 miles, passing through Lintha and Ngapali, two coast villages. Mayo bay, in the south-east corner of Andrew bay, affords shelter during the South-west monsoon, but a shoal with a depth of 2½ fathoms over it, situated in the centre, contracts the anchoring space.

Mills patch.—A shoal with a depth of 3¼ fathoms over it, thrown up by a small mud volcano in 1908, lies 4½ miles westward of Money point, and is a danger to vessels making Andrew bay. *See* page 82.

Anchorage.—Andrew bay affords good anchorage in fine weather, but it is exposed to the full force of the South-west monsoon.

Water.—A well of good water is situated on the shore of Sandoway bay, and here native boats obtain water.

Tides.—It is high water, full and change, in Andrew bay at 9h. 21m.; springs rise 8 feet, neaps rise 5 feet; neaps range 3 feet.

COAST.—From Money point the coast trends in a southerly direction, with a curve to the westward, for a distance of 4½ miles, forming a promontory which extends nearly 5 miles from the general direction of the coast; at Hmau-gon, about three-quarters of a mile eastward of the south-west point of the promontory, is a white pagoda, which is a conspicuous object from seaward, when the sun is shining.

A large area of foul ground extends more than 3 miles westward of the promontory, and should be carefully avoided; the outer patch, which dries 3 feet, being 4 miles west-south-west of Money point.

From the pagoda, which has a remarkable rock eastward of it, the coast turns to the eastward for about 6 miles, and then to the southward for 15½ miles to Bluff cape, a conspicuous point. Padaung islet is situated in the bight at the turn of the direction of the coast, and at 3¾ and 4½ miles, respectively, are the entrances to Kamyit and Salu, two small rivers; Kyeintali river, entering the sea about 2 miles eastward of Bluff cape, is navigable for boats.

Dangers.—Numerous shoals and banks, generally of coral formation, exist to the westward of this coast, and this locality requires exceedingly careful navigation, especially during the South-west monsoon.

Carpenter shoals, consist of two separate shoal areas, each about 1½ miles square, the western of these, situated 12¼ miles south-south-eastward of Unguan island, has a least depth of 3¾ fathoms, over its centre, with a bottom of coral rock.

The eastern shoal, on which there is a least depth of 2¾ fathoms, over a similar bottom, is about 3 miles east-south-east of the western, and several banks, with depths under 10 fathoms, exist in this locality, but none constitute dangers.

FOUL ISLAND (NANTHAKYUN) (*Lat. 18° 3′ 51″ N., Long. 94° 5′ 39″ E.*), an active mud volcano, 551 feet high, nearly square, and about one mile in extent, is thickly wooded, except for a strip on its western side, where the volcano, when in activity, has cleared away the trees and formed a bare lane, or course, extending down to the water; the crater, situated to the westward of, and just below, the summit, was in violent eruption in February, 1908, with flames reported to reach a height of 500 feet above the summit.

The position given is that of the summit ascertained by the survey in 1908.

Shoal water extends nearly three-quarters of a mile off the north-east point of Foul island.

Anchorage.—Good anchorage may be obtained in depths of from 8 to 10 fathoms, over a bottom of sand and mud, at a distance of one mile from the north end of the island.

Supplies.—Fish are very numerous over the coral shoals in the vicinity of Foul island, especially rock cod and red mullet, and are easily caught.

General charts 829, 70.

Chart 822, Chedúba strait to Koronge island. Var. 0° 50′ E.

Brougham shoal, with less than one fathom water over a rocky bottom, and nearly always breaking, is about half a mile in extent, and dangerous; it lies $4\frac{3}{4}$ miles north-north-eastward of the summit of Foul island.

New shoal, with a depth of 3 fathoms over rocky bottom, is situated $9\frac{1}{10}$ miles E. by N. from Foul island summit.

Satellite ledge (*Lat. 18° 5′ N., Long. 94° 18′ E.*), with 14 fathoms water over it, lies 4 miles eastward of New shoal.

Vestal shoal, with a least depth of 5 feet over it, lies $6\frac{6}{10}$ miles E. by S. from Foul island summit; it generally breaks, but, having an area of nearly one mile, it is dangerous.

Robinson shoal, of small area and composed of coral, with a least depth of 4 feet over it, and generally breaking, is situated $1\frac{3}{4}$ miles eastward of Vestal shoal, with a channel in which the depth is 25 fathoms between.

William shoal consists of two rocky heads nearly one mile apart, with deep water between; the western has a depth of $5\frac{1}{2}$ fathoms over it, and the eastern, with $2\frac{1}{2}$ fathoms water, is situated $13\frac{3}{10}$ miles east-south-east of Foul island summit.

Investigator ledge, small and of coral, with a least depth of 12 fathoms, is $4\frac{2}{10}$ miles south-east of Foul island summit.

Currents.—The currents in the vicinity of these shoals are influenced by the monsoon, but it has been observed that they are also affected by the tides, both in strength and direction; they set strongly across the shoals.

Caution.—If proceeding eastward of Foul island, pass within 3 miles of it, to ensure clearing the above shoals.

COAST.—Bluff cape, rising steeply from the sea to a height of 450 feet, is a moderately conspicuous landmark, and from it the coast trends somewhat eastward of south for a distance of 25 miles to Gwa, with between some summits on the coast, which are easily recognised from seaward; of these may be mentioned High peak, 1,920 feet; Quoin hill, 830 feet; and Brown cape, or Button hill, 409 feet, near on the coast, and North Sharp peak, 3,760 feet, and South Sharp peak, 2,320 feet high, on the back range of hills.

The only village of any importance on this stretch of coast is at Hswathwa river, which, like Kyeintali river, has a narrow entrance and a shallow bar, but Hswathwa river, being almost closed by reefs, can only be approached by a passage from the southward, near the shore. Hswathwa village exports a certain amount of rice and salt fish to Akyab during the fine season.

General charts 829, 70.

Chart 822, Chedúba strait to Koronge island. Var. 0° 50′ E.

Foul rocky ground extends off Hswathwa river mouth for a distance of 2½ miles.

Thyne bank and White bank, of coral, have 15 and 12 fathoms water over them, and lie, respectively, 13 miles west-south-west, and 10½ miles south-westward of High peak.

GWA (*Lat. 17° 33′ N., Long. 94° 35′ E.*) is a small town at the narrow entrance to the river of the same name, which is fronted by a bar of sand, just outside the narrows, on which the greatest depth at low water is 7 feet. A reef of rocks extends about three-quarters of a mile south-westward of Rocky point, the north point of the bay.

Anchorage.—The anchorage in Gwa bay, outside the river mouth in depths of from 4 to 6 fathoms, is open to westerly winds.

Tides.—It is high water, full and change, at 9h. 30m. in Gwa bay; springs rise 8 feet, neaps rise 5 feet; neaps range 2 feet.

Town.—Gwa is surrounded by a grove of fruit trees, the houses are generally good, and the roads broad and cross at right angles; in 1901 the population was 1,436. During the North-east monsoon a little trade is carried on by sea with Bassein district to the south, and Chinese junks occasionally anchor off the village.

Communication.—A small steamer from Sandoway, stopping at Kyeintali and Hswathwa en route, calls once every week during the fine weather season, and a road connects Gwa and Sandoway, by which mails are sent weekly; there is a post and a telegraph office.

Hospital.—A hospital was in course of construction in 1908.

Trade.—A little trade in grain and salt fish is carried on during the fine weather, these being principally exported to Akyab.

Gwa island, 2½ miles south-south-westward of the entrance to Gwa bay, is half a mile in length in a north and south direction, 144 feet high, and forms an excellent mark.

A rock, which dries 5 feet, is situated 1$\frac{6}{10}$ miles north-north-east of Gwa island summit, and foul ground extends around the island and between it and the mainland; the channel to the eastward of the island is only navigable for boats, and for those who have local knowledge respecting the rocks in it.

BASSEIN DISTRICT.—From Gwa the Bassein district has a coastline of nearly 100 miles to the entrance to Bassein river, with no ports of any importance. *See* Chapter I., page 45.

St. Johns or Church rocks, 13 miles west-south-west of Gwa island, are four in number, and extend for a distance of about a quarter of a mile in a north-west and opposite direction; the largest rock, 40 feet high, on a south-westerly bearing, resembles a church.

General charts 829, 70.

Chart 822, Chedúba strait to Koronge island. Var. 0° 50′ E.

The rocks are steep-to at the northern end, but shoal water extends for a distance of 6 cables to the southward of them.

COAST.—From Gwa bay the coast trends in a general southerly direction for nearly 40 miles, and then south-south-westward to Cape Negrais; off it the depths are very irregular, with numerous off-lying rocks and dangers, so that it is not advisable to navigate inside depths of from 20 to 25 fathoms.

The coast is rocky, and broken up into several small bays, which, although affording anchorage in fine weather, give but little shelter in the South-west monsoon. Danson bay, about 24 miles southward of Gwa bay, is the best of these, being well sheltered from the south and south-west.

Bomie bay, about 15 miles southward of Gwa bay, has also a river, navigable for boats, and those which carry on a certain amount of trade in the fine season are cutter shaped and junk rigged.

There are also rivers, navigable for boats, at Kyaung-Tha, Hsengma or Round island, and Nga-yot-chaung, all having a certain amount of export trade in rice, and dried fish, in fine weather; Hsengma has a timber industry and a sawmill.

Danson bay (*Lat. 17° 11′ N., Long. 94° 29′ E.*), about 8 miles southward of Bomie bay, and the most protected anchorage from the south and south-west, between Chedúba strait and Cape Negrais, extends about 3 miles in a south-east direction, and is about 2 miles in width at its entrance. Round hill, 637 feet, and Thumb hill, 780 feet high, situated about 2 miles inland from the eastern coast of the bay, are very conspicuous from seaward.

Anchorage for large vessels may be obtained in depths of from 5 to 6 fathoms, but when entering, West Sandy islet should be given a good berth, to avoid the reef and rocks which extend about a mile westward of it.

Supplies of fresh provisions are almost impossible to be obtained, but water may be procured from two streams situated just to the northward of the entrance.

Kyaung-Tha river.—High island, 14 miles southward of West Sandy islet, is small, 130 feet high, and lies about a mile south-westward of the entrance to Kyaung-Tha river, which is navigable for boats, and the nearest point on this coast to the town of Bassein.

Several reefs are situated off the entrance to the river, and a heavy swell breaks on the bar, except in fine weather; boats intending to enter the river should pass to the northward of High island, and exercise care when landing, on account of the reef off the river entrance.

General charts 829, 70.

Chart 822, Chedúba strait to Koronge island. Var. 0° 50′ E.

Communication.—There is a large village at Kyaung-Tha, and the road over the hills having been recently (1909) improved, it is expected that a postal service will be established.

CALVENTURAS (Hgnettaung) (*Lat. 16° 53′ N., Long. 94° 16′ E.*) consist of two groups of rocky islets, the North-west group being 10 miles westward of Broken point, which point is about 3 miles south-west of High island; the highest rock of the North-west group is 125 feet high, and North island, of the South-east group, is about 4 miles east-south-east of it, with a channel between in which there is a depth of 24 fathoms.

North and South island, of the South-east group, are 130 and 80 feet high, respectively, and the summits of all the islets are wooded, forming good marks. There is a navigable channel between the South-east group and the mainland, but the channel between North and South islands should not be attempted, as a rock which dries 7 feet lies midway between them, and there are two large rocks to the northward of South island.

COAST.—Between Broken point and Koronge island, a distance of 23½ miles, the coast is broken and has several islets and off-lying reefs, the principal being Chaung-gyi island, 110 feet high, Round or Hsengma island, 130 feet, Mile Stone rock, 40 feet, Little Quoin island (Thit-yaung), 130 feet high, High island, North, West, and South reefs, and Saba island and rocks.

Alligator's head, a large rocky promontory situated nearly 20 miles south-south-west of Broken point, when seen from seaward has the appearance of an alligator's head, facing to the southward; it is the northern point of Nga-Yot bay.

Sinma or Hsengma, a large village, situated about 10½ miles southward of Broken point, on the northern side of the entrance to the Thit-po river, has a steam sawmill where timber is prepared for export, and extensive repairs are carried out to local trading boats.

The Thit-po river is navigable for boats, and those intending to enter should pass to the northward of Round island, which lies westward of the entrance, to avoid St. Mary's and other rocks; the river bar should only be attempted at high water.

Supplies.—A few fowls, and some fruit and vegetables may be obtained.

Vibart shoal, 1½ miles in length in a north and south direction, and half a mile in breadth, has a least depth of 2½ fathoms, over sandy and rocky bottom; it lies 2$\frac{8}{10}$ miles south-westward of Round island.

General charts 829, 70.

Chart 822, Chedúba strait to Koronge island. Var. 0° 50′ E.

Mile Stone rock, about 6½ miles south-westward of Round island, and 4½ miles from the coast, is a large solitary rock, 40 feet high, with deep water all round it and no outlying dangers.

Nga-yot bay, north-eastward of Koronge island, is about 3½ miles in width, open, and affording little protection, except from the southward; as there are several dangers in the bay, it should not be used by large vessels. Nga-yot-chaung, a river navigable for boats, enters the bay at its southern end, and Nga-yot-Taung, 1,317 feet high, and one of the most conspicuous mountains on this coast, is about 4 miles inland from the eastern shore of the bay.

North, West, and South reefs, with High island, lie off the coast to the northward; a patch with a depth of 3 fathoms over it lies in the centre of the bay, and in its southern part are Saba rocks, with a 4¼-fathoms patch between.

A rock, 4 feet high, is situated three-quarters of a mile north-westward of North rock of Koronge island, and several reefs and outlying rocks are off the coast.

KORONGE ISLAND (*Lat. 16° 32′ N., Long. 94° 15′ E.*), 1¾ miles in length in a north and south direction, about 4 cables in breadth at its southern, and tapering to a point at its northern, end, is rocky, wedge shaped, 265 feet high, and presents a very rugged appearance; it is quite precipitous on its inshore side, and North rock, large and detached, is situated off its northern end.

The channel between the island and the mainland is about 6 cables in width, but, being obstructed with reefs and foul ground, it is not navigable for anything larger than boats, and they should keep close to the island side when passing through.

Anchorage.—Good anchorage may be obtained in a depth of 6 fathoms, over sand, between the south end of Koronge island and the mainland, protected from the north and north-west, but care is necessary to avoid Crawford shoal and a rock which dries, situated one mile south-eastward of the south-east point of Koronge island.

Chart 823, Koronge island to White point.

Crawford shoal, lying 2¾ miles south-westward of the south-west point of Koronge island, consists of a group of rocks which dry 4 feet, with deep water close to the northern side, but shoal water extending for a distance of half a mile to the southward.

May-gaumgaun, Ung-chume, and Lichune islands, 65, 175, and 120 feet high respectively, form a group, situated from 6 to 9 miles southward of Koronge island, and about one mile from the coast; rocks and foul ground extend for some distance round all

General charts 830, 70.

Chart 823, Koronge island to White point. Var. 0° 50′ E.

these islands, and a patch, on which the depth is 2¾ fathoms, lies about half a mile south-westward of May-gaumgaun.

Saingbain Kieu, or the Buffaloes, a group of large detached rocks, extending for 3 miles in a direction parallel to the coast, from which they are distant about 2 miles, are very conspicuous, several of them showing white; North Twin and South rock are the northernmost and southernmost, respectively, and Pillar rock, 43 feet above high water, is the highest.

Round cape, 16 miles southward of Koronge island, is a conspicuous, thickly wooded point, 340 feet high, off which shoal patches with a least depth of 4¾ fathoms lie at a distance of 1½ miles in north-west and west directions.

Conical mountain (Yot-pa), 736 feet high, and situated 4 miles south-eastward of Round cape, is conical shaped and conspicuous, showing distinctly from seaward in all directions. This mountain, with Spike hill, 850 feet, and Fat hill, 650 feet, are the most easily distinguished summits between Koronge island and Cape Negrais.

Chart 834, Bassein river.

Black rock, about 5 miles south-south-west of Round cape, and 2 miles from the coast, is a solitary, dark coloured rock, 4 feet above high water.

CAPE NEGRAIS (*Lat. 16° 2′ N., Long. 94° 11′ E.*), 14 miles southward of Round cape, is prominent, with cliffs steep to the waters edge; the summit of the cape, about half a mile inland, is 410 feet high, and forms the extremity of a spur of the Arakan Yoma, which range stretches to the north-north-eastward nearly parallel to the coast of Burma.

Pagoda point (Mawdeng), the south-west extreme of Burma, lies 6 miles south-south-east of Cape Negrais, and between is a succession of low hills most of them densely wooded; towards Pagoda point some remarkable bare, reddish slopes of blown sand show a well-defined edge of dark foliage near their summits.

The land in this vicinity should not be approached to a nearer distance than 3 miles, and even then with caution, as, in addition to a reef which skirts this coast, there are many outlying rocks.

Chart 823, Koronge island to White point.

Currents.—Between Gwa and Cape Negrais the currents running with the monsoon take the direction of the coast, and rarely exceed a rate of one knot an hour.

Chart 823, Koronge island to White point. Var. 0° 50′ E.

Juanita shoal (*Lat. 16° 0′ N., Long. 93° 40′ E.*), a coral bank about 10 miles in length, within the 100-fathoms contour line, in a north and south direction, and 3 miles in width, with a least depth of 16 fathoms, is situated 30 miles westward of Cape Negrais.

Directions.—A sailing vessel, beating round Cape Negrais, should shoal the water, standing in-shore, to about 10 fathoms, and stand off to depths of 18 or 20 fathoms. In proceeding northward a good offing should be kept, passing westward of all rocks and shoals, and using the lead frequently.

From the proximity of the mountains, the winds are baffling during the North-east monsoon, and in the South-west monsoon the weather is bad, so that it is generally inadvisable to work up in-shore; but if such a course should be determined on keep in anchorage depths, and take advantage of the land and sea breezes, and the uncertain currents.

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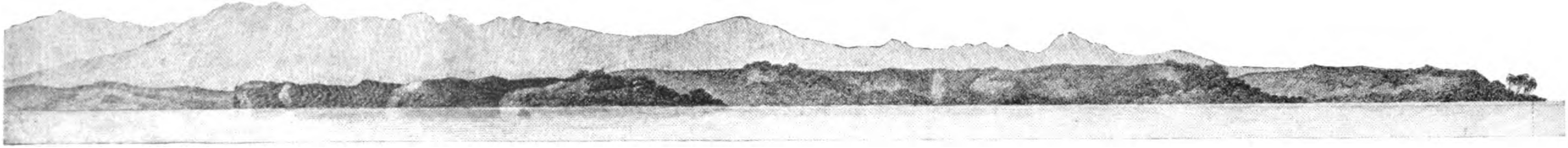

Parsons point, bearing East.

View of southern extreme of Great Nicobar island.

CHAPTER VIII.

THE NICOBAR, ANDAMAN, AND COCO ISLANDS.

(Lat. 6° 44′ N. to Lat. 14° 12′ N.)
(Long. 92° 6′ E. to Long. 94° 17′ E.)

VARIATION: Decreasing 2′ annually.

Chart 840, Nicobar islands. Var. Nil.

NICOBAR ISLANDS.—The Nicobar group extends for a distance of 163 miles in a north-north-west and south-south-east direction, with an extreme width of 36 miles, and consists of twelve inhabited and seven uninhabited islands. The group is fully described in Chapter I., page 59.

GREAT NICOBAR (native name Loöng), the southern and largest of the islands of the Nicobar group, extends for about 29 miles, in a north and south direction, with breadths of from 7 to 14 miles; its northern part is the highest, where it attains, in Mount Thuillier, an altitude of 2,105 feet; the southern part, although lower, is still high.

Near the centre a mountainous range, with a known height of 1,333 feet, extends north-eastward across the island; the western side of the island, being open to the South-west monsoon, has not been examined. The whole island is thickly covered with trees, and the soil is of great fertility. In the interior the natives are of a different race to those of the coast, and do not intermix with them.

Plan of South bay (Galathea bay) on 840.

South (Galathea) **bay** (*Lat. 6° 47′ N., Long. 93° 52′ E.*), at the southern end of Great Nicobar island, is an indentation about 1¾ miles in extent, where there is fair anchorage during the North-east monsoon in 9 to 10 fathoms, but, owing to its position, the heat is excessive.

Walker island, small and flat, lies on the western side of the bay, about 9 cables northward of Parsons point, the southern point of Great Nicobar. (View, page 375.)

Galathea river (Dak Kea), small and navigable for a considerable distance by boats, flows into the head of the bay, but a sand bar closes its mouth at low water.

General charts 830, 70.

Plan of South bay (Galathea bay) on 840. Var. Nil.

Landing can be effected by canoes at a gap in the reef about 1¼ miles northward of Walker island, and at a similar gap on the eastern side of the bay, half a mile northward of Hayward or Kwangtung point, the eastern entrance point of the bay.

Chart 840.

EAST COAST.—The east coast of Great Nicobar island is imperfectly known; it is hilly, wooded down to the sea, and indented; probably there are places where anchorage may be obtained during the South-west monsoon, when the water on this side of the island is smooth.

From Hayward point the coast trends in a north-north-east direction of 3½ miles, and then turns to the westward, forming the southern side of a bight 6½ miles in length, with several indentations in it, the southern being named Mataita-ánla.

Boat rock, about a mile south-eastward of the northern point of this bight, has three smaller rocks south-westward of it. Campbell bay is situated northward of the bight, and southward of its north entrance point is Cerberus rock.

From Koal-ta-pain, the point immediately northward of Campbell bay, the coast trends in a north-north-west direction for 11 miles to Lafúl anchorage.

Plan of Lafúl anchorage on 840.

Lafúl anchorage is an open bight, about three-quarters of a mile in length in a north and south direction, with a ledge of shoal water nearly 2 cables in width extending off it which affords anchorage; this ledge is apparently steep-to.

Directions.—Steer West for the middle of the southern half of the sandy beach, which is conspicuous from seaward, and anchor just before the southern part of the coast is shut in by South point: caution is necessary, as the water shoals suddenly.

Chart 840.

Trinkat Champlong bay (*Lat. 7° 13′ N., Long. 93° 51′ E.*), situated 3 miles north-north-westward of Lafúl anchorage, affords safe anchorage in the South-west monsoon in depths of from 7 to 10 fathoms, at half a mile off-shore. At the entrance of the bay the water shoals suddenly from 22 to 10 fathoms; thence to the shore the soundings decrease regularly, but a vessel should not approach the shore to a less depth than 6 fathoms.

A shoal, with a depth of 2½ fathoms over it, was reported, in 1887, to lie about 1¼ miles north-eastward of Murray point, the north entrance point to Trinkat Champlong bay, but its position is doubtful.

General charts 830, 70.

Plan of St. George's channel on 840. Var. Nil.

Kabra (native name Konwana), a small island, 309 feet high, is nearly 3 miles northward of Murray point.

Ganges harbour, on the western side of a point which lies about 2½ miles westward of Murray point, is a bight about 2½ miles in width in an east-north-east and opposite direction, and nearly midway between its entrance points is a middle ground, upon which there are depths of from 4½ to 8 fathoms, and two rocks with about half a fathom water over them; on each side of the middle ground is a channel with depths of from 17 to 27 fathoms.

Shoal water, on which there is a patch of 3½ fathoms, extends nearly a mile westward of the eastern entrance point of the harbour.

Anchorage may be obtained in from 9 to 16 fathoms water, over a bottom of coarse sand and clay.

Kondul island (native name Lamongshe), 3 miles westward of the west point of Ganges harbour, is rocky, 2 miles in length in a north-north-west and south-south-east direction, with a hill, 400 feet high, near its centre. The northern side of this island is lofty and rocky, but safe landing may be obtained on its eastern side.

Anchorage may be obtained on the eastern side of the island in a depth of 7 fathoms about half a mile from the shore.

Kondul harbour (*Lat. 7° 12′ N., Long. 93° 42′ E.*), between the north-west side of Great Nicobar island and Kondul island, from which it receives protection from the northward, is an airy anchorage, distantly situated from mangrove swamps.

Shoal.—A shoal, with a depth of 2½ fathoms over it, but which has not been examined, lies about 8 cables south-south-east of the south-eastern point of Kondul island.

Anchorage.—There is anchorage in depths of from 12 to 17 fathoms, over sand and coral, between Kondul island and the shore, and eastward or north-eastward of the shoal; or off the western side of the island in 10 to 12 fathoms water, according to the direction of the prevailing wind.

Chart 840, Nicobar islands.

WEST COAST.—The west coast of Great Nicobar island, which, as already stated, has not been examined, trends to the southward for a distance of about 11 miles from the north-west extreme of the island to a point on the western side of Casuarina bay, from which it trends to the south-south-eastward for 19 miles to Parsons point, the south extreme of the island.

Dangers.—A bank, with depths of 7 to 8 fathoms, on which there may possibly be less water, extends 3 miles off-shore, about 7 miles

Chart 840, Nicobar islands. Var. Nil.

south-westward of Kondul island, and there are irregular soundings some distance northward and westward of the bank.

A patch of small extent on which a depth of 4½ fathoms was obtained, but probably having less water, is situated on the western side of Great Nicobar, distant 2¾ miles south-south-eastward of the south-western point of the headland on the northern side of Casuarina bay. For a distance of 5 miles to the southward of this patch numerous shoals have been reported.

The edge of the plateau on which Great Nicobar island stands, and which apparently extends a considerable distance from its coast, has not been determined.

Anchorages (*Lat. 7° 0′ N., Long. 93° 41′ E.*).—Casuarina bay affords good anchorage during the North-east monsoon, in a depth of 11 fathoms, at about one mile to the southward of the north-west point of the bay.

At the entrance to a bight between the villages of Kopen-héat and Táe-angha, 5½ miles south-south-east of Casuarina bay, there is anchorage in a depth of 15 fathoms, about one mile from the shore, but great care is necessary in approaching either of the above anchorages, as numerous shoals are reported to exist from 3 to 5 miles off-shore.

Caution.—Great Nicobar and Kondul islands should not be approached closely, as unknown rocks may exist.

Plan of St. Georges channel on 840.

St. Georges channel separates Great and Little Nicobar islands, the water in it is deep with an uneven bottom; the tidal streams set fairly but strongly through the channel, the flood to the north-eastward, the ebb to the south-westward.

Chart 840, Nicobar islands.

LITTLE NICOBAR ISLAND (native name Ong), 12¾ miles in length in a north-north-east and opposite direction, by about 6 miles in breadth, narrows considerably towards its northern part; it is mountainous, the highest summits being Mount Deoban, 1,428 feet high, near the centre of the island, and Empress peak, 1,420 feet high, north-eastward of it. The island is thickly covered with swamp and forest.

East coast.—From Cape Edinburgh, the south extreme of the island, the east coast trends in a north-east direction for about 11 miles, and then turns abruptly to the north-west for 5½ miles to Sombrero point, the north extreme of the island.

Menchál island, nearly a mile in extent, is situated about 1¼ miles to the northward of the point where the coast changes its direction, the channel between having depths of from 21 to 30 fathoms.

Chart 840, Nicobar islands. Var. Nil.

Anchorage may be obtained during fine weather in from 6 to 7 fathoms water at half a mile south-westward of Menchál island, but the tidal streams are reported to be very strong, especially at springs.

Plan of Pulo Milo on 840.

West coast.—From Cape Edinburgh, the west coast has a northerly direction for 8 miles to Pahua, and between it and Sombrero point, a distance of 5½ miles in a north-east direction, a bight, receding about 2 miles, is formed in which is Pulo Milo (native name Miloh), about 7 cables in length and 4 to 5 cables in breadth.

Dangers.—Coral reefs extend off the coast of Little Nicobar, eastward of Pulo Milo, and a 3-fathoms patch lies about half a mile eastward of the north-eastern point of the latter island.

Anchorage may be obtained in the channel between Pulo Milo and Little Nicobar, which is about 4 cables wide, with depths of 9 to 13 fathoms, over sand and coral; it is accessible in all winds, and is well sheltered.

Landing can be effected on Little Nicobar and on the eastern side of Pulo Milo; it is believed that no fresh water for drinking can be procured.

The natives are reported to be inoffensive and willing to trade, but are very poor.

Chart 840, Nicobar islands.

SOMBRERO CHANNEL, separating Little Nicobar island from Katchall and Nankowry islands, is 30 miles in width between Sombrero point and Cape Albany, the south point of Katchall; the depths are somewhat irregular, there being 51 and 305 fathoms nearly in mid-channel.

Treis (native name Taan) **and Trak** (native name Fuya) **islets** lie about 3½ and 4½ miles, respectively, west-north-west of Sombrero point, the northern point of Little Nicobar island; there are sunken rocks in their vicinity, and midway between Treis, from which a reef extends a quarter of a mile, and Sombrero point is a rock with less than 6 feet of water over it.

Anchorage.—There is anchorage three-quarters of a mile north-eastward of Trak, in a depth of 6 fathoms, but the bottom is uneven and the tidal streams are very strong.

Meroe islet (native name Miroe) (*Lat.7°31′N.,Long.93°31′E.*), low and about a mile in length, is situated 10½ miles west-north-west of Sombrero point; landing is only practicable on it in the finest weather.

General charts 830, 70.

Chart 840, Nicobar islands. Var. Nil.

Banks.—A detached coral bank, about 7 miles long in a north-north-east and south-south-west direction, and 4 miles in greatest width, with 9 to 17 fathoms on it, is situated in the northern part of Sombrero channel, its northern edge being about 3 miles south-south-east of Cape Albany.

A patch with a depth of 12 fathoms, over yellow clay, lies 12¼ miles westward of Cape Albany, Katchall island, and other shoal ground may exist in the vicinity.

Tidal streams.—In Sombrero channel the flood stream sets north-westward, and the ebb stream south-eastward; the streams are said to attain in places a rate of 5 knots at springs.

KATCHALL ISLAND (native name Tehnyu) is irregular in shape, about 11 miles in length in a north-west and south-east direction, and about 6 miles in width, except at its southern part, where it is about 2 miles; there are some bays round its coast. The island, which is covered with forest, reaches a height of 835 feet; it furnishes cocoanuts, ambergris, tortoise-shell, and edible birds' nests.

South bay, about 3 miles in width, has rocks and foul ground in it, and should not be entered.

Plan of Hoinipoh bay on 840.

Hoinipoh bay, situated about midway on the east side of the island, affords good anchorage in a depth of 8 fathoms, with the village bearing W. by S., distant 3 cables: it is much frequented by vessels trading to the island.

Chart 840, Nicobar islands.

East bay is reported to have very irregular depths, varying from 5 fathoms to no bottom at 20 fathoms, but anchorage may be obtained in it with the east point bearing S.S.E. ¾ E., distant one mile.

West bay affords anchorage in a depth of 9 fathoms at a distance of one mile south-south-west of its north-west point, but a south-west swell is reported sometimes to set in during the North-east monsoon, and the tidal streams attain a rate of 2 knots across the entrance.

Landing.—Good landing can be effected inside the north-west point of West bay.

Revello channel, between Katchall and Camorta and Nankowry islands, is about 3¾ miles in width, and is apparently free from dangers.

NANKOWRY ISLAND (*Lat. 7° 58′ N., Long. 93° 32′ E.*), eastward of Katchall, is 6½ miles in length in a north and south direction, and about 4½ miles in extreme breadth; it is 534 feet high and thickly wooded. A reef of rocks, dry at low water, extends about a mile southward of Cape Connaught, its southern point.

General charts 830, 70.

Chart 840, Nicobar islands. Var. Nil.

CAMORTA ISLAND (native name Nankauri), northward of Nankowri island and separated from it by Nankowry harbour, is 14 miles in length in a north and south direction, and generally about 4 miles in width; its average height is about 200 feet, but the summit of the southern part is 735 feet, and a hill in the middle of the island is 435 feet high. On both sides of the island there are villages and huts along the coast. Camorta is picturesque, owing to the alternations of forest and grass slopes, with the white coral beach crowned with cocoa-nut palms.

Plan of Nankowry harbour, 841.

Nankowry harbour (*Lat. 8° 2′ N., Long. 93° 30′ E.*), between Camorta and Nankowry islands, is commodious and sheltered from all winds; it has two entrances, one on the east, and the other on the south-west, and can be entered or left without difficulty in either monsoon.

On the northern side, within the eastern entrance, is Fort or Octavia bay, in which the depths are from 10 to 16 fathoms, and opposite it on the southern side is Spiteful bay, with from 5 to 18 fathoms water, while between these is Cross harbour with depths of from 12 to 27 fathoms; westward of the latter a channel about 3¾ cables in width communicates with Satellite bay, on the north, and Wasp bay on the south side, which have general depths of from 8 to 30 fathoms.

Outer anchorage.—In the South-west monsoon there is anchorage in False bay, north-eastward of Naval point, where the holding ground is said to be good, but a long scope of cable is necessary, as the squalls off the land are heavy.

Eastern entrance.—Depths.—The eastern entrance, in which the depths are from 19 to 22 fathoms, is about 2¼ cables in width between the shoal water extending about one cable off Jub point on the south, and about 2 cables off Naval point on the north side, the latter, marked by a white beacon, which must be left to the northward when entering.

A promontory about one mile wide, of which Reid point is the north-east, and Mayo point the north-west, extreme, forms the southern side of the eastern entrance, and Naval point the south-east extreme, of Camorta, is the north entrance point.

Beacons.—The extremity of the reef, extending 2 cables southward of Naval point, is marked by a beacon, consisting of an iron post, surmounted by a drum painted white, the whole 5 feet above high water.

The shoal extending about 1½ cables north-westward of Leda point is similarly beaconed.

Plan of Nankowry harbour, 841. Var. Nil.

Western entrance.—Depths.—Indian point is on the southern side of the western entrance, its northern side being formed by the south extreme of a peninsula at the south end of Camorta, of which Man point is the south-east extreme. The western entrance, between Indian and Man points and leading into Wasp bay, is rather more than one cable in width, and has depths of from 27 to 30 fathoms.

Buoy.—A nun buoy, painted black, is moored about three-quarters of a cable south-westward of Battery point, in Fort or Octavia bay.

Satellite patch (*Lat. 8° 2′ N., Long. 93° 30′ E.*), a detached patch with a depth of 2¼ fathoms, over coral, and from 4 to 5 fathoms around it, lies about 8 cables south-westward of Alfred point, the east point of Satellite bay.

Rock.—A rock, which covers at high water, lies 3½ cables from the eastern shore of Wasp bay, about one mile southward of Leda point.

Inner anchorages.—The most convenient anchorage for trade is off the settlement, nearly 2 cables south-westward of the jetty, and 4 cables westward of Naval point.

Fort or Octavia bay, the eastern of the northern bights, is clear and affords anchorage in a depth of 11 fathoms. Sailing vessels entering Satellite bay should guard against the sudden changes of wind caused by the formation of the land.

Spiteful bay, the eastern of the southern bights, is narrow, and extends southward for 1½ miles, terminating in an extensive mud bank, dry at half ebb; it should not be entered unless the reefs in it have been previously buoyed. The most convenient anchorage is in the middle of its entrance, in a depth of about 12 fathoms, which position is open to the sea breeze.

Directions.—Eastern entrance.—The coast south-eastward of Reid point should be given a berth of about a mile, to avoid the shoal off it, and when that point bears about S.W. steer to pass nearly in mid channel, between Jub and Naval points, and southward of the beacon marking the shoal south of the latter point to the anchorage off the settlement; if proceeding to Satellite bay, pass northward of the beacon marking the shoal off Leda point.

Western entrance.—Pass midway between Indian and Man points, observing that, although all the rocks are above water, the tidal streams run strongly between the points, and there are also eddies, so that caution is necessary. After passing the entrance steer N.E. by N. through Wasp bay, until Alfred point, the north-east point of Satellite bay, bears N. by E. ¼ E., when alter course for it, and when Naval point bears E. by N. ¾ N. steer for it, which leads midway

General charts 840, 830, 70.

Plan of Nankowry harbour, 841. Var. Nil.

between the shoals extending from Leda and Alfred points, passing northward of the beacon marking the shoal off Leda point to the anchorage westward of Naval point.

Tides.—It is high water, full and change, in Nankowry harbour, at 9h. 15m.; springs rise 8 to 8½ feet.

Tidal streams.—The flood stream sets eastward, the ebb westward; and in the entrances the stream attains considerable strength, though weak inside the harbour.

Settlement.—The settlement is situated 1½ miles north-westward of Naval point, at the place where a penal settlement existed between 1869 and 1888.

Jetty.—A jetty extends nearly 400 feet from the shore at the settlement, about a quarter of a mile westward of Naval point.

Supplies.—Pigs, fowls, yams, and cocoanuts can be procured, and a small quantity of fresh water obtained from a stream between Naval and Battery points.

Chart 840.

EAST COAST.—From Naval point the east coast of Camorta island trends to the northward for 3½ miles, then turn to the north-north-west for about 5 miles and north-north-eastward for an almost similar distance, forming a bight which recedes about 2½ miles. Trinkat island is separated from this coast by Beresford channel.

Moshóit, a village, situated on the northern side of the bight above mentioned, has a reef extending off it which may be easily seen with a good light, and anchorage may be obtained about 2 cables north-eastward of it, with the north-east extreme of Camorta bearing N. by E. ¼ E., and the north-east extreme of Trinkat S.E. ¼ E.

WEST COAST.—The west coast of the island from the south extreme of the peninsula which forms its southern part trends in a northerly direction for 5¼ miles to Dring harbour, with Expedition harbour about midway. From Dring harbour it curves round to the westward of north, and then turns north-east to Horace point, the north extreme of the island, the distance of each of the stretches being about 5 miles.

Plan 841.

Expedition harbour (Ho Ho bay) (*Lat. 8° 3' N., Long. 93° 28' E.*), the entrance to which is 2¾ miles northward of the southern point of Camorta, is a considerable land-locked harbour, extending 1½ miles north-eastward and then opening out to Grand harbour, which has not been surveyed; it is separated from Nankowry harbour by a low, narrow, irregular peninsula, but owing to the

Plan of Nankowry harbour, 841. Var. Nil.

numerous mangrove swamps it is undesirable except as a temporary anchorage.

Entrance.—Depths.—Satellite point, on the southern side of the entrance, is almost free from danger, but Wasp point, on the northern side, has a reef extending nearly 1½ cables south-westward of it; the entrance between the edge of this reef and Satellite point is about half a cable in width, with depths of from 9 to 13 fathoms.

Anchorage.—The anchorage in a depth of 12 fathoms, over soft mud, is with Devils point, situated half a mile north-north-east of Wasp point, bearing N. by W. ½ W., distant about one cable.

Directions.—Expedition harbour should be approached with extreme caution, especially from the northward, as in that direction are several outlying dangers which only show at low water. Bring Edgcumbe point on the east side of the harbour to bear N.E. ½ E., and steer in with it on that bearing, passing close to Satellite point, and when Devils point bears North steer for the anchorage as convenient, but do not proceed above Devils point, as within it the harbour has been but partially examined, and there are several shoals.

Tides.—Springs rise 8 feet.

Water.—A little fresh water may be obtained at the rivulet northward of Wasp point, the northern entrance point, but it is said to be of doubtful quality.

Chart 840, Nicobar islands.

Dring harbour (*Lat. 8° 6′ N., Long. 93° 28′ E.*) can only be entered by boats, but anchorage may be obtained outside in a depth of 10 fathoms, about half a mile westward of the entrance.

Rock.—A rock, with a depth of one fathom over it, lies about 2 miles northward of the entrance to Dring harbour and three-quarters of a mile off-shore, and, as a depth of 14 fathoms has been found between Dring harbour and the rocks, and breakers have been reported in this vicinity, there may be less water.

Perseus reef apparently commences from the shore about 3 miles northward of Dring harbour, and extends off it for a distance of 2¼ miles from a point, 3 miles further north; its northern edge then trends eastward and joins the shore reef off Koi-hóa.

Koi-hóa village is situated 3¾ miles south-west of Horace point, and anchorage may be obtained in from 7 to 9 fathoms water about one mile off-shore at the village, but no protection is afforded in the South-west monsoon by Perseus reef.

TRINKAT ISLAND (native name Laful), on the eastern side of Camorta, is 5½ miles in length, in a north and south direction, and

General charts 830, 70.

about one mile in width, very low and level, with numerous cocoanut palms; it is nearly divided near its centre by a deep bight, which has a village at its head.

Beresford channel, between Trinkat and Camorta, is about a mile wide, but is believed to be blocked by reefs and sandbanks.

Anchorage is sometimes obtained in 8 or 9 fathoms, between the north point of Trinkat and Camorta, but as there are numerous reefs in this vicinity, local knowledge is necessary to use it.

TILLANCHONG ISLAND (native name Laok) is 10 miles in length, in a north and south direction, and less than a mile in width, and Cape Winifred, its southern point, is 12½ miles north-north-east of Horace point, the northern point of Camorta; the island is visited occasionally by natives from Chowra and Bompoka islands. The island is steep, with a jagged ridge, and rises at Mahárâni peak, nearly in its middle, to a height of 1,058 feet.

A chain of needle-like rocks extends for a distance of nearly 3 miles south-eastward of Cape Winifred, and the Isle of Man (Laouk), the highest of the chain, situated near the extremity, is 404 feet high.

Several detached rocks lie off other parts of Tillanchong island, and Piara rock, about 352 feet high, is situated half a mile north-westward of Cape Maud, its northern point.

Castle bay (*Lat. 8° 27′ N., Long. 93° 37′ E.*), on the south-east coast of Tillanchong, is a fair anchorage in fine weather, but care is necessary to avoid a rock reported to exist about a quarter of a mile southward of Castle bay point; it can be seen in a good light, and there is deep water between it and the shore.

Anchorage has been obtained on the western side of Tillanchong island in Novára bay.

TERESSA ISLAND (native name Taihlong), about 14 miles north-westward of Katchall, is 12 miles in length and about 2½ miles in width, and curved in a north-west to north-north-east direction; it is sparsely populated. From a distance it appears like two islands, its central part being considerably lower than the northern or southern parts; its northern part reaches a height of 897 feet. Reefs extend from its northern, western, and southern side, but especially from the last; it is not advisable to visit the island during the South-west monsoon.

East coast.—From the east end of the island the east coast trends in a west-north-west direction for 6 miles, and then north-north-east for about 4 miles.

Keráwa, about 4 miles from the east end, has no safe anchorage, as a depth of 27 fathoms was found at a distance of a quarter of a mile off-shore.

Haoin or Bengála, 3½ miles northward of Keráwa, is not a safe anchorage, although vessels sometimes anchor off it; there is good landing.

West coast.—The west coast trends in a west-north-west direction for 6 miles, and then curves gradually round to north-north-east for a distance of 9 miles.

Laksi, a village consisting of a few huts, is 3¼ miles from the east end of the island, and can be easily made out from seaward; anchorage may be obtained abreast of it at about three-quarters of a mile off-shore.

Landing can often be effected through an opening in the reef at Laksi when it is unsafe at Hinám.

Hinám (*Lat. 8° 15′ N., Long. 93° 5′ E.*), a village about 4 miles north-westward of Laksi, is only visible from seaward on a North-east bearing. Anchorage may be obtained in from 6 to 14 fathoms water close to the shore, and a good path from the village crosses the island to Keráwa.

Landing is not always practicable even in the North-east monsoon.

Bompoka island (native name Poahat), separated from the south-eastern part of Teressa by a channel, 1½ miles wide, in which are depths of 30 and 50 fathoms, is 2¾ miles in length in a north-north-west and south-south-east direction, 1½ miles in width, 634 feet high, and sparsely wooded; the inhabitants are few.

Anchorage may be obtained at Póahat, on the western side of the island, in a depth of 14 fathoms, about a quarter of a mile off-shore, with the village, in line with the north peak of the island, bearing N. 40° E., but the water shoals rapidly, and caution is necessary when anchoring.

Supplies.—Yams, bananas, and papaia may be procured.

Chowra island (native name Tatat), 6¾ miles north-westward of the north point of Teressa, is generally low, but its south end rises almost perpendicularly in a rocky pinnacle to a height of about 343 feet, having the appearance, with the contiguous low portion, of a flap hat, whence it was named Sombrero by the early Portuguese navigators; the natives are morose in disposition, and are disliked by those of the other islands; they manufacture pottery, and the only cooking pots used in the group come from this island.

Reefs are said to extend about 1½ miles from the north-west side of Chowra.

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Chart 840, Nicobar islands. Var. 0° 10′ E.

Anchorages.—A village, which has indifferent anchorage off it, is situated on the eastern side of the island.

Anchorage may also be obtained, in from 9 to 10 fathoms water, at half a mile off-shore, abreast Sánénya village, on the northern part of the east coast.

Supplies.—Hogs, poultry, and tropical fruits, especially limes, are obtainable, probably in small quantity.

Tidal streams.—The flood stream in the vicinity of Chowra island sets north-eastward, and the ebb south-westward.

Coral bank.—About 2¼ miles north-westward of Chowra is the southern end of a coral bank, with depths of 1½ to 2¾ fathoms on it, which occupies a space of about 2½ miles in length in a north-east and south-west direction, and 1½ miles in width, but its limits have not been determined.

Batti Malv island (*Lat. 8° 50′ N., Long. 92° 51′ E.*) (native name Et), situated 23 miles north-north-west of Chowra, is about 150 feet in height, and from a distance appears wedge shaped; it is small, the upper portion thickly wooded, and is without inhabitants. Batti Malv is low near the coast at its north-western end, whereas on the western, southern, and south-eastern sides, the rocks descend perpendicularly to the sea.

Reefs appear to extend half a mile from the north-western and south-western sides of the island.

Anchorage.—Indifferent anchorage may be obtained north-westward of the island, but the landing is bad.

CAR NICOBAR (native name Pu), the northern island of the Nicobar group, is 8 miles in length in a north and south direction, 7 miles in width, and thickly covered with forest, and the highest ridge in the south-western part of the island is about 200 feet in height. The northern and north-western points of the islands should not be approached closely, as foul ground extends from them. Large numbers of cocoanuts are exported from this island, chiefly to Burma.

Kémios bay, on the southern side of Car Nicobar, affords anchorage during the North-east monsoon, when the landing is good. Trading vessels anchor in depths of from 10 to 12 fathoms, about midway between the two villages situated on the shore of the bay, which is a convenient position for shipping cocoanuts.

Tidal streams.—The tidal streams in Kémios bay are regular and strong; the flood stream sets east-south-east about 3 knots at springs, the ebb in the opposite direction.

East coast.—From Kákana on the south-east side of the island the east coast curves round from the north-eastward to north-north-

General charts 830, 70.

Chart 840, Nicobar islands. Var. 0° 10′ E.

west to Keating point, the north extreme of the island, a distance of 10 miles; at about 4, 4½, and 5 miles from Kákana, are Malacca, Perka, and Tamálu villages, off which anchorage may be obtained in a depth of 14 fathoms at 1½ miles from the shore, and landing effected in ordinary monsoon weather.

Lapáte, about 3 miles north-north-west of Tamálu, has anchorage in a depth of 12 fathoms, north-eastward of the village and about half a mile off-shore.

Mús, about one mile north-westward of Lapáte, has anchorage in depths of from 7 to 8 fathoms, with the village bearing S.W. ½ S., distant 4 cables, but the tidal streams are said to run at a rate of 4 knots at springs, and a vessel might drag the anchor.

West coast.—The west coast, from the south-west point of the island, trends in a northerly direction for 5½ miles, and then sweeps round Sáwi bay to Keating point.

Arong, situated 2¼ miles northward of the south-west point of the island, affords anchorage, in from 9 to 11 fathoms water, at about half a mile from the shore; it should be approached with the village bearing East.

Landing is practicable in fine weather, but care is necessary, as the channel between the rocks is only 20 feet wide.

Plan of Sáwi bay on 840.

Sáwi bay (*Lat. 9° 14′ N., Long. 92° 46′ E.*), on the north-western side of the island, affords anchorage in a depth of 12 fathoms, over rock, coral, and a thin surface of sand, about three-quarters of a mile northward of Sáwi village, and in 7 fathoms water off Observation spot point, where there is good landing for boats at low water.

A patch, with apparently a least depth of 5½ fathoms, coral, over it, lies 6 cables north-westward of Observation spot point.

Village.—Water.—The principal village of the island is situated in Sáwi bay. Fresh water, in case of necessity, may be procured at Areka rivulet, but not without difficulty.

Tides.—It is high water, full and change, in Sáwi bay at 10h. 0m.; springs rise 5 feet. The flood stream runs north-eastward.

Chart 840, Nicobar islands.

Tidal streams.—The streams around Car Nicobar are rapid, and cause tide races, particularly northward of the island.

At 6 to 8 miles eastward of the island, in the month of February, and the tide being at one-quarter ebb, a current or tidal stream, setting south-west at the rate of 7 knots an hour, was experienced.

General charts 830, 70.

Chart 840, Nicobar islands. Var. 0° 10′ E.

Within a few miles of the Nicobar islands the flood tidal stream generally sets north-eastward and the ebb south-westward; the streams attain in the channels between the islands a rate of 3 to 4 knots.

Currents.—In the offing of the Nicobar islands the current usually sets with prevailing wind, but is variable both in rate and direction; its rate sometimes reached 50 miles a day.

Chart 830, Bassein river to Pulo Penang.

TEN DEGREES CHANNEL, about 77 miles in width, separates Car Nicobar and Little Andaman islands; it is deep and clear. The tenth parallel of north latitude passes through it near its centre.

Chart 825, Andaman islands.

ANDAMAN ISLANDS extend for a distance of 229 miles in a north and south direction, with an extreme width of 32 miles, and are said to number 204. The main part of the group is a chain of five chief islands, so close to each other and overlapping that they are considered as one, and named Great Andaman. Little Andaman island is the southernmost, and Table island the northernmost, of the group, which is fully described in Chapter I., page 60.

The whole of the Andaman group lies 1′ 15″ further eastward than charted.

Natives.—Caution.—*See* page 62.

LITTLE ANDAMAN ISLAND, named Egu belong by the inhabitants, who are of the Onges tribe, is well wooded, and about 600 feet high in the centre. From a distance the island appears nearly level, rising gradually from both ends towards its summit.

West coast.—The west coast appears to be fringed by a coral reef, with a sandy beach from Sandy point, its south-western point, nearly to Jackson creek, 16 miles northward; it then trends north-eastward 10 miles to the northern point of the island.

Jackson creek (*Lat. 10° 48′ N., Long. 92° 23′ E.*), a small bay into which a stream runs, can be distinguished by a conspicuous square block of trees that falls abruptly to the water's edge. A reef appears to extend northward for three-quarters of a mile from the western point of the bay, and there is said to be anchorage inside the end of the reef. Just southward of Jackson creek the coast is cliffy, and on the north-eastern side of the bay there are some remarkable cliffy sandstone islands, hollowed with caves.

Bumila creek, on the north side of the island, and so named from the flies which infest it, cannot be recognised until close off the river, which then shows as a gap in the trees, the land being quite

Chart 825, Andaman islands. Var. 0° 10′ E.

low at the north end of Little Andaman. A coral reef, on which the sea generally breaks, stretches nearly across the entrance to Bumila creek; the channel, round the west end of this reef, has from 7 to 8 feet in it at low water.

Anchorage.—The anchorage, in a depth of 8 fathoms, over dead coral, about 4 cables northward of the entrance, with the centre of the river bearing S.S.E., should be approached from the north-westward, in which direction the water is clear; off the north-eastern coast of the island towards the Brothers there are irregular shallow soundings.

Tidal streams.—The streams set about E. by N. and S.W. at the anchorage off Bumila creek, and there is sometimes a strong ebb stream out of the creek.

Dalrymple bank,, nearly circular, and about 7 miles in diameter within the 20-fathoms contour line, lies with its centre about 9 miles westward of Sandy point, Little Andaman. The general depths on this bank are from 13 to 18 fathoms, over broken dead coral, but near the centre there are ridges of rock with as little as 5½ fathoms over them. Possibly less depths may exist, and the bank should not be crossed, especially in the South-west monsoon, when there are heavy rollers on it. There are depths of over 30 fathoms at 3 to 4 miles westward of the shoal centre.

South Sentinel (*Lat. 10° 58′ N., Long. 92° 12′ E.*), 17½ miles in a west-north-west direction from Bumila creek entrance, is a small uninhabited level-topped island with a low point on its southern side; the summit of the trees on it is 144 feet high, and it has much the same appearance on all bearings. It is separated from Little Andaman by deep water, and stands on a bank which trends 6 miles north-westward of it, with depths of 11 to 19 fathoms, over coral, surrounded by deeper water.

Anchorage.—The western side is the most shelving, and anchorage can be obtained, in a depth of 14 fathoms, 8 cables W. by N. from the centre of the island, with the extremes of the island subtending an angle not greater than 35°. Turtle are plentiful here, and there are greater numbers of the robber crab.

Landing.—There are practically no shoals outside the fringing reef which surrounds the island; landing can only be effected on its northern side, and in fine weather.

Chart 1398, Port Blair to Little Andaman island.

Rock.—In 1899, the master of the steam vessel *Onipenta* reported striking a sunken rock or wreck about 15 miles eastward of South

Chart 1398, Port Blair to Little Andaman island. Var. 0° 10′ E.

Sentinel, when South Brother island bore S.E. by E. ½ E., distant 8 miles.

The Brothers (native name of the north island Detale, and of the south Egu-china-koi), two small flat-topped islands, lying 4½ and 9 miles north-eastward of the north-east side of Little Andaman, are wooded, the summits of the trees on both being about 90 feet high; and each has a lagoon in the middle, the water in which is very brackish and unfit to drink, except during a heavy fall of rain. Numbers of grey pigeons breed on South Brother.

A reef surrounds North Brother, and extends about half a mile north-westward of it; and between the two islands is Leeboard ledge, a detached shoal, the position of which is approximate. The passage between the Brothers should not be used for navigation.

A reef is situated south-eastward, and another, awash and generally breaking, lies about 1¼ miles north-north-west, of South Brother, with foul ground between which also extends 5 miles west-north-westward from the island.

Between South Brother and Little Andaman the channel is 4½ miles wide, but Ariel ledge, a detached reef, occupies its centre, narrowing the channel considerably, and the soundings are so irregular that the passage should not be used.

DUNCAN PASSAGE, 9½ miles in width, between North Brother and Sisters islands, is the main channel between Little and South Andaman islands; it is unsurveyed, and a shoal, the depth on, and extent of, which is uncertain, is reported at 2½ miles north-east of North Brother, but the general depths in the channel are believed to be from 12 to 20 fathoms, over sand, so anchorage might be obtained if necessary.

Directions.—In light breezes and fine weather the tidal streams set eastward and westward in Duncan passage, but sometimes a current caused by the winds runs through it. In the North-east monsoon, on both sides of the Andaman islands, the current sets south-westward, or southward, and in the South-west monsoon northward to eastward. A sailing vessel, in making Duncan passage, should therefore keep a little northward in the North-east, and southward during the South-west monsoon, so as to preserve a leading wind through the channel.

To clear the foul ground north-westward of South Brother, North Brother should not bear eastward of E. by S. while the eastern extreme of Little Andaman island bears southward of S.S.E.; the position of the rock reported by the *Onipenta* should also be given a wide berth (page 390).

The Sisters (*Lat. 11° 9′ N., Long. 92° 43′ E.*), two small islands, the eastern 306 feet, and the western 232 feet, in height, lie close

General charts 825, 830, 70.

Chart 1398, Port Blair to Little Andaman island. Var. 0° 10′ E.

together on the northern side of Duncan passage, on a bank with depths of from 5 to 12 fathoms, over coral, and the 100-fathoms contour line passes about a mile eastward of them; a rocky spit extends 7 cables north-westward of the ledge connecting the two islands.

The native name of the eastern island is Takoa-te, and of the western island Te-joma-de.

Passage island (native name Chogada), 3½ miles north-westward of the Sisters, is three-quarters of a mile in length in a north and south direction, and a quarter of a mile in width; its north end, 351 feet high, is rounded, but the south end is low.

A detached rock, 6 feet high, lies about 3 cables northward, and a bank, having from 6 to 10 fathoms water over it, is situated about 2 miles west-south-westward, from the island; the latter consists of a narrow rocky ridge fringed with sand, with overfalls over it at spring tides.

The channel between Passage island and South Cinque island is 3 miles wide and clear; it has an average depth of 28 fathoms, but there are tide rips at springs.

Cinque islands, two hilly narrow islands, almost joined by a rocky ledge, awash at high water, are moderately high, and extend in a north-north-east and south-south-west direction for about 6 miles. The trees on both islands are most remarkably contorted by the South-west monsoon.

South Cinque island (native name Ga-o-ta-koi) is 545 feet high, and has a conical knoll 410 feet high at its southern end.

North Cinque island (native name Gue-a-lue) has two summits, 529 feet and 569 feet high, forming a saddle near its northern end; and at its south end is a small, conical, bare hill, 293 feet high, from which a promontory projects westward.

Anchorage.—There are depths of from 7 to 10 fathoms, over dead coral and sand, with the west point of the north island bearing N. by W., and westward of the sunken ledge joining the islands, and this is the only place around the islands where anchorage can be obtained.

Tides.—It is high water, full and change, at Cinque islands at 9h. 47m.; springs rise 7 feet, neaps 4¾ feet.

Manners strait (*Lat. 11° 20′ N., Long. 92° 40′ E.*), between Cinque islands and Rutland island, is 3 miles in breadth, and has depths of from 18 to 40 fathoms in mid-channel; there are usually tide rips across it. This passage is used by steamers, and, with a leading wind, is preferable to Duncan passage for sailing ships.

General charts 825, 830, 70.

Chart 1398, Port Blair to Little Andaman island. Var. 0° 10′ E.

RUTLAND ISLAND (native name Ga-tin-a-koi), on the northern side of Manners strait, is 10½ miles long in a north and south direction, and about 4 to 6½ miles broad; the southern part of the island reaches a height of 744 feet, and the northern part is high, culminating in Fords peak (Kalapahar), a peak 1,422 feet above the sea. The northern and southern parts of the island are joined by a low neck of land formed by two bays.

The island is densely wooded; access to it is difficult, and the natives are most hostile.

Portman bay is a deep indentation on the east coast, having a mangrove swamp and shallow water at its head and irregular deep soundings in the centre; a considerable swell sets into it in the North-east monsoon.

Wood-Mason bay, on the west coast, has its northern part filled with reef, but its southern part appears to be clear of shoals.

Bank.—A bank of dead coral, extending about 5 miles in a north and south direction, and from 3½ to 4½ miles in width, with a depth of not less than 6 fathoms over it, lies with its centre 6½ miles south-westward of the south-western point of Rutland island, and is quite safe to pass over in ordinary weather.

Investigator rock, with a depth of 3 fathoms over it, and nearly always marked by tide rips, lies 9 cables south-south-west of the south extreme of Rutland island; depths of under 10 fathoms extend about 6 cables southward of the rock, and 2 cables east and west, and a patch of 4½ fathoms lies about 3 cables north-eastward of the rock.

As rocks and irregular patches extend some distance off the south coast of Rutland island, it should not be approached within 1½ miles, except on the eastern part, where it is clear to half a mile.

The Twins (*Lat. 11° 24′ N., Long. 92° 33′ E.*) are two level-topped wooded islets on the northern side of a bank, with depths under 10 fathoms, which extends 3½ miles westward of the south-west side of Rutland island, from which East Twin, 144 feet high, is distant 1½ miles and the West Twin (Tekouta) 2 miles in a westerly direction, both islets being situated on a reef.

A rocky ledge extends about 8 cables south-westward from West Twin, and at its extreme is Turtle rock, which is only covered at high water; this ledge continues to the southward for a similar distance, and has on it a patch with a least depth of 1½ fathoms.

LABYRINTH ISLANDS, fourteen in number, are all rocky and fringed with coral reefs; on their seaward face coral reefs project nearly a mile, large blocks of which are broken off by the sea during the South-west monsoon and are thrown on the reefs, appearing like

General charts 825, 830, 70.

rocky boulders. The channels between the islands are nearly full of coral heads, but the passage between Malaytapu and Jolly Boys island, the two south-eastern islands, leading to the western end of Macpherson strait, is navigable with proper caution.

Tarmugli island.—*See* page 435.

WESTERN APPROACH TO MACPHERSON STRAIT.—Jolly Boys island, 149 feet high, lies three-quarters of a mile north-westward of the northern part of Rutland island; coral reefs, which are generally visible, extend around the island, and for 7 cables south-westward, and 2 cables westward and north-westward of it.

Boat island, 1½ miles long, half a mile broad, and 199 feet high, is the south-western of the group, and a coral reef projects one mile southward from it. Natives resort to this island for fishing.

Tides.—It is high water, full and change, on the north-eastern side of Boat island at 9h. 24m.; springs rise 6¼ feet, neaps 3½ feet.

Malaytapu, nearly one mile north-north-westward of Jolly Boys island, has a rounded summit at its north end, 282 feet high; a rocky ledge extends a quarter of a mile off its south point.

Hobday island, close north-eastward of Malaytapu, has a rocky ledge extending off it for half a mile towards the north point of Jolly Boys island, and from the end of the ledge a ridge with depths of from 3½ to 4½ fathoms continues half a mile further southward.

Pluto island, 162 feet high, small and rounded, lies half a mile eastward of Hobday island, and is useful as a leading mark.

Dangers.—Brooker rock, a pinnacle of rock with 5 feet over it at low water, lies 8½ cables south-south-westward of the south point of Malaytapu; there are depths of 5 to 14 fathoms close around this rock, which is usually obscured by the discolouration of the water.

Beauchamp patch, a small coral head awash at low water springs, 3½ cables north-north-east of the north point of Jolly Boys island, is not often visible owing to the discolouration of the water.

Peck shoals are a cluster of coral heads lying north-eastward of Beauchamp patch, and on the northern side of the channel into Macpherson strait.

MACPHERSON STRAIT (*Lat. 11° 30′ N., Long. 92° 35′ E.*), between Rutland island and South Andaman island, is 8 miles in length, with a least navigable width of about 2 cables, and a least depth of about 4½ fathoms between its western and eastern entrances, the former being narrow and much blocked by coral reefs.

Chart 1398, Port Blair to Little Andaman island. Var. 0° 10′ E.

Although both shores of the strait are fringed with coral reef, the edges of which in places show above water, that portion of it between the north-east side of Rutland island and the south-west side of South Andaman island is clear, excepting a ledge of rocks which projects 6 cables east-north-eastward from Rutland island abreast Chiriyatapu, and can always be distinguished.

Chiriyatapu, the eastern entrance point, is a conspicuous bare promontory, 219 feet high, under which are some caves in which edible birds' nests are found, and half a mile westward of the point is a rock, one foot above high water, with deep water westward of it; the passage between the rock and the point should not be used.

Anchorage.—There is anchorage in depths of from 6 to 10 fathoms in the northern part of the eastern portion of the strait with Chiriyatapu point bearing S.E. ⅞ E., distant 1½ miles.

Directions from westward.—When at least 5 miles off the entrance of the strait bring Jolly Boys island to bear N.E. ½ E., and steer towards it on that bearing until Pluto island is open one-third of its length eastward of the south-east side of Hobday island, N. 34° E., which mark leads south-eastward of Brooker rock. Steer N. 34° E. with the above mark on, passing about 2½ cables westward of Jolly Boys reef, which is generally visible, and about that distance off Brooker rock by not bringing Pluto island any nearer to the south-east side of Hobday island.

When Jolly Boys island summit is abeam alter course to N.E. until the south extreme of Boat island is just open southward of the south extreme of Malaytapu, S. 85° W., and then steer N. 85° E. with this mark on astern, which leads between Peck shoals and Beauchamp patch, and to the entrance of the strait, through which keep in mid-channel, observing that the western entrance shut in by the northern shore of the strait, bearing N. 68° W., leads northward of the ledge extending from the north-east side of Rutland island.

The least depths passed over in the above route are from 4 to 4½ fathoms.

Tidal streams.—The tidal swirls are not strong in the vicinity of Brooker rock and Beauchamp patch, and the tidal stream is rapid only in the narrows northward of the islet which marks the western entrance point of the strait. The flood stream sets eastward, and the ebb westward, the streams turning at high and low water.

Chart 825, Andaman islands.

NORTH SENTINEL ISLAND (*Lat. 11° 33′ N., Long. 92° 14′ E.*), nearly 4 miles square, is about 15 miles westward of Labyrinth islands, the channel between being clear, with depths of

General charts 825, 830, 70.

Chart 825, Andaman islands. Var. 0° 10′ E.

from 23 to 52 fathoms, over ooze. This island is 400 feet high, thickly wooded, and has a level ridge, which slopes to a very low north-west point; the natives are timid and hostile, and the island is seldom visited by Europeans.

A coral reef nearly surrounds the island, extending from the shore for distances of from a half to three-quarters of a mile, and the lagoons inside the reef have depths of from 3 to 8 feet; no dangers exist outside the reefs, and the 100-fathoms contour line passes 3 miles westward of the island.

There are only two good entrances through the reefs, one on the west coast, just southward of a small islet; the other, and better, on the southern side of the island, eastward of a small islet, and about three-quarters of a mile westward of Constance islet, at the south-eastern corner of the island.

Anchorage may be obtained in a depth of 12 fathoms about half a mile off the second of the two entrances.

INVISIBLE BANK, about 36 miles in length in a north and south direction, and 9 miles in greatest width, lies about 45 miles eastward of Duncan passage; near the centre of the bank there is an area about 10 miles in length, with depths under 20 fathoms, outside which the depths vary from 23 to 92 fathoms, and the water over it does not appear discoloured.

Flat rock (*Lat. 11° 8′ N., Long. 93° 29′ E.*), awash at high water, and about 30 yards in diameter, is situated on Invisible bank, about 15 miles from its south end. There is a depth of 7 fathoms nearly one mile southward, and of 6 fathoms 2½ miles northward, of the rock.

Caution.—Vessels in the vicinity of Flat rock should use the lead constantly.

Barren island, nearly 50 miles north-north-east of the north extreme of Invisible bank, is 1,158 feet high, and 2 miles in diameter; there are no dangers round the island at half a mile distant. The crater, near the centre of the island, is old and choked, its outer slope being covered with foliage; on the western side, the crater wall is broken down and permits a view of the interior, and a thin column of steam issues from a sulphur bed on the side and near the summit of the cone.

Plan of Barren island anchorage on 825.

Anchorage.—There is anchorage, in about 15 fathoms water, at 2 cables off a beach on the south-western side of the island, and here the tidal stream at half flood has been observed running south-eastward at a rate of 2½ knots, the vessel being kept continually swinging round the anchor on the ebb.

General charts 825, 830, 70.

Plan of Barren island anchorage on 825. Var. 0° 10′ E.

Landing may be effected in a nook formed by an outflow of lava through the gap in the crater wall; a hot spring, the temperature of which has been found to be 110° Fahr., trickles through the beach near the landing place.

Water.—There is no water on the island in the dry season except the hot spring, the water of which is just palatable when cooled. The island is infested by rats.

Chart 825, Andaman islands.

Narcondam island (*Lat. 13° 26′ N., Long. 94° 16′ E.*), an extinct volcano, 2,330 feet high, in the shape of a truncated cone, has several small rocks above water lying close around it, outside which there appears to be deep water. There is said to be anchorage one cable westward of a large rock on the north-north-western side of the island, which also forms some shelter for landing.

Landing on the island is difficult and dangerous, except during the calm weather of February and March; Barata bay, on its eastern side, where there is a shingle beach, and, in very calm weather, no surf, is the best landing place, but there is no anchorage. The bay may be known by the groves of palm trees (*Caryota sobolifera*).

Chart 1398, Port Blair to Little Andaman island.

SOUTH ANDAMAN ISLAND, on the northern side of Macpherson strait, is 45½ miles in length in a north and south direction, and from 2½ to 16 miles in width. Ports Blair and Meadows are situated on its eastern side, and Ports Mouat and Campbell on its western side.

East coast.—The east coast of South Andaman island from Chiriyatapu point, at the northern side of the entrance of Macpherson strait, northward to abreast Sesostris shoal, a distance of 11 miles, is bold and clear to the fringing reef which extends off about 3 cables in places. The 100-fathoms contour line approaches this coast to about a distance of 2 miles.

Plan 514, Port Blair.

PORT BLAIR is an excellent harbour and the head-quarters of the representative of the Indian Government at the Andaman and Nicobar islands. A Government Penal Settlement was established at Port Blair in 1858.

Vessels are not allowed to visit Port Blair for commercial purposes, except under government contracts, and in order to visit and trade at the Nicobars a permit must be obtained from Port Blair.

Tea, coffee, cocoa, paddy, Indian corn, and vegetables are cultivated. The edible bird's nests are now a government monopoly, and yield a revenue of about Rs. 3,000 yearly.

General charts 1398, 1414, 825, 830, 70.

Plan 514, Port Blair. Var. 0° 20′ E.

The port has two outer entrances, formed by Ross island, and an inner entrance, 8½ cables wide, between Atalanta and Perseverance points, from which it extends westward for about 2 miles, and then southward for a similar distance to Navy bay; from Navy bay it extends as a shallow inlet past Viper island to Flat bay at the head, and on both shores from the entrance to its head there are several indentations.

Sesostris shoal consists of two coral patches, the outer of which, lying half a mile off-shore, and 9 cables south-eastward from South point, has a least depth of 13 feet over it; the inner patch, about a cable south-west of the outer, has 12 feet water over it.

Buoy.—A conical buoy, painted black, is moored in 8 fathoms water on the eastern edge of the shoal.

ROSS ISLAND (*Lat. 11° 41′ N., Long. 92° 45′ E.*).—South point, on the north side of which is a pier, is the south-western point of the south entrance to the port; the south point of Ross island, 4 cables north-east of it, forming the other point. The island is 7 cables in length in a north-north-east and south-south-west direction, 3 cables in greatest width at its centre, and about 195 feet high.

At its north end is the barracks, a dark stone building with battlements about 56 feet high, south-westward of which, on the highest part of the island, is Government house, approached by a road leading from a wooden pier on the western side.

Except at the centre of its western side, the island is surrounded by a fringing reef.

LIGHTS.—A wooden structure, 56 feet in height, on the north-eastern corner of the barracks at the north end of Ross island exhibits, at an elevation of 163 feet above high water, a *white fixed* light, which should be visible in clear weather from a distance of 12 miles.

Two *red fixed* lights are shown from the end of the wooden pier at the western point of Ross island.

Shoal.—A shoal extends about a quarter of a mile north-westward of the pier on the western side of Ross island.

Buoys.—Two conical buoys painted black, each in a depth of 7 fathoms, are moored one at the northern and the other at the western extreme of the shoal.

A mooring buoy, painted black and white in checks, for the Government vessel stationed at Andamans, lies nearly 1½ cables south-westward of the pier end.

General charts 1398, 1419, 825, 830, 70.

Plan 514, Port Blair. Var. 0° 20′ E.

Atalanta point, about 8 cables north-westward of South point, has a cellular jail on it which is very conspicuous. A reef surrounds the point for a distance of about a cable.

Caution.—The jail must not be mistaken for the barracks on Command point, when entering by South entrance.

Sesostris bay (*Lat. 11° 40′ N., Long. 92° 44′ E.*), between South and Atalanta points, is nearly filled with reefs; an 18-feet patch lies on the line joining the points, and 3 cables southward of Atalanta point. Two piers form a boat harbour in the bay.

Wireless telegraph.—Four masts, each 150 feet high on the shore of Sesostris bay, are for wireless telegraph purposes.

Leading lights.—From a tower, 7 feet in height and painted white, situated on South point, a *white fixed* light is exhibited at an elevation of 40 feet above high water.

At one cable N. 11° W. from the preceding a tower 7 feet in height, painted white, and situated on the end of South point pier, exhibits a *white fixed* light at an elevation of 7 feet above high water.

These lights in line, bearing S. 11° E., lead through the northern part of the south entrance.

On the higher part of Atalanta point, about 3 cables from its extreme, a *white fixed* light is exhibited, at an elevation of 144 feet above high water, from a tower 7 feet in height and painted white.

At 1½ cables N. 35° E. from the preceding, a *white fixed* light is exhibited, at an elevation of 70 feet above high water, from a tower 7 feet in height and painted white.

These two lights in line, bearing S. 35° W., lead through the northern entrance.

Red and *green fixed* lights are shown from the piers in Sesostris bay.

Outer anchorage.—Anchorage may be obtained westward of Ross island, in a depth of about 50 feet, over sand, and from one cable to 2 cables south-westward of the jetty; this anchorage is not a very safe one in bad weather.

Entrances.—The south entrance between South and Atalanta points on the west and Ross island on the east, is about half a mile wide between the shoals which fringe both sides.

The northern entrance, between the north point of Ross island on the south and North and Perseverance points on the north, is 8 cables in width between the 5-fathoms contour lines.

Depths.—The least depth in the southern channel on the line of the leading mark is 31 feet, and on a similar mark for the northern channel 21 fathoms; the depths at the anchorage in the port are from 36 to 50 feet.

South shore.—Phœnix bay, a small inlet about 8 cables westward of Atalanta point, is used for repairing boats.

Blair reef, extending 4 cables north-eastward from the western entrance point of Phœnix bay, is rocky, with some parts of it 2 feet above water.

Buoy.—A buoy, painted black, is moored northward of the north-eastern extreme of the reef.

Clearing mark.—Shore point open of the eastern extreme of Chatham island, bearing N. 67° W., leads northward of Blair reef.

Blair point, nearly 1½ miles west-north-westward of Atalanta point, is surrounded by reefs, which extend about 1¼ cables from it.

Chatham island (*Lat. 11° 41′ N., Long. 92° 43′ E.*), 89 feet high, and a quarter of a mile northward of Blair point, is used for sawmills; it is steep-to on its northern side, but its southern side is separated by a narrow shallow passage from the reef surrounding Blair point.

North shore.—North bay, an arm of the harbour immediately westward of North point, has a coral reef fringing its shores, extending, on the western side, for nearly 2 cables, and a sand flat dries for about that distance from the head. Perseverance point, its western entrance point, is 8 cables south-westward of North point.

Command point, one mile westward of Perseverance point, is about 171 feet high, and on it are whitewashed barracks, which are not conspicuous. Eastward of the point is Semiramis bay, where there is a pier and watering place; and westward is Command bay, on the eastern side of which are coal sheds and piers where large vessels coal alongside. Hope town is situated on the north-eastern side of Command bay.

Buoys.—Two buoys, painted red, are moored in Command bay for securing off-shore hawsers, as, to keep clear of the fringing reef, vessels must lie about 10 feet from the pier ends, at which distance there is a depth of 30 feet.

Mount Harriet, 1,193 feet high, is situated about 1¼ miles inland northward of Semiramis bay, the land descending rapidly from it to the shore; it is sometimes used as a sanatorium, and a good road leads to it from the pier.

Bamboo Flat bay, half a mile westward of Command point, extends half a mile northward; at its head are a foundry, a smithy, and a boat-building shed.

Plan 514, Port Blair. Var. 0° 20′ E.

Ranger flat.—Shore point, which separates Bamboo Flat bay from Brigade creek, lies nearly a mile westward of Command point, and off it Ranger flat, with from 3 to 18 feet water, over a bottom of mud and sand, extends about 3 cables southward and 4½ cables eastward.

Clearing mark.—Perseverance point in line with the northern extreme of Chatham island, bearing N. 84° E., leads southward of Ranger flat.

Brigade creek extends along the west side of the land at Shore point, and turns to the westward, where it is joined by Stewartganj and other creeks; immediately westward of its entrance is Mangrove bay, filled with a bank on which are mangroves

Viper island (*Lat. 11° 40′ N., Long. 92° 41′ E.*).—Dundas point is 1⅓ miles southward of Shore point, and nearly 2 miles south-west of it is Tapping point, with a bight formed between, in which is Viper island, covered with buildings, including a convict jail and a blanket manufactory. South-westward of Viper island the harbour is quite shallow.

Navy bay, eastward of Viper island, has depths varying from 20 to 25 feet; at its eastern end are sawmills, and a rifle range.

Anchorage.—The best anchorage in the harbour is in depths of from 7 to 8 fathoms, over mud, with the north extreme of Chatham island bearing E.N.E., the island being distant about half a mile; here there is complete shelter.

Directions.—Coming from the southward and intending to enter by the south channel, the whitewashed barrack on Command point open to the northward of Atalanta point, bearing N. 48° W., leads north-eastward of Sesostris shoal, and through the southern entrance between South point and the south extreme of Ross island, and when the leading light towers on South point and its pier come in line, bearing S. 11° E., alter course to N. 11° W., with them as a stern mark, which will lead through the northern part of the channel.

If intending to anchor westward of Ross island, when South point bears S. ½ W. steer N. ½ E. for the anchorage.

If using the north channel, pass about half a mile northward of Ross island and a quarter of a mile southward of Perseverance point, midway between it and Blair reef, observing that Shoal point, in line with the east extreme of Chatham island, bearing N. 67° W., leads northward of Blair shoal, then steer in mid-channel between Chatham island and Command point, rounding the north-west end of Chatham island at a distance of about one cable, and steer about S.W. by W. for the anchorage; Perseverance point kept in line with

General charts 1398, 1419, 825, 830, 70.

the north extreme of Chatham island, bearing N. 84° E., leads southward of Ranger flat.

Tides.—It is high water, full and change, at 9h. 36m.; mean springs rise 6 feet, mean neaps 5 feet.

Port Blair (*Lat. 11° 40′ N., Long. 92° 45′ E.*).—The Penal Settlement centres round the harbour of Port Blair, the administrative head-quarters being on Ross island, and the settlement is divided into two Districts and four subdivisions, the whole aim of the treatment being to educate for useful citizenship; every religion in India is represented.

Population.—In 1906 the free population numbered 2,976, and the total of convicts 14,691, including women and children; of the convicts 8,559 were imprisoned for the crime of murder.

In 1906 the total military strength was 517, of which 155 were British; the police military battalion was 595 strong.

Communication.—Steam vessels of the Asiatic Steam Navigation Company bring mails from Calcutta every four weeks, and also an intermediate mail from Rangoon.

The settlement has eight large and two small steam launches, besides lighters, barges, and boats of all sizes. Steam and animal tram lines are laid in various parts, the latter being chiefly to the forests.

There is a wireless telegraph station in connection with Rangoon *viâ* Table and Diamond islands, and various parts of the settlement are connected by telephone.

Coal and supplies.—About 1,000 tons of coal are kept in stock, and 5,000 tons imported annually; a coal wharf 350 feet in length, has a depth of 30 feet alongside. Coaling is carried on by baskets, and 800 tons could be put on board in 24 hours; 9 lighters are also available.

Fresh provisions can be procured from the commissariat, and excellent water is brought alongside in tanks from Hopetown. At Ross island, water is led down the hill side in pipes to the pier, and can be turned on into a boat alongside, but its quality is not so good as the Hopetown water. There is a small marine store for supplying the settlement steamers.

Repairs.—Nearly every kind of trade is taught, and in the Phœnix bay workshops a large variety of work is carried out, including repairs to machinery, boilers, pumps, &c., and large castings in brass and iron can be made.

Quarantine.—The port is healthy as the forest in its immediate vicinity has been cleared. Two barracks are reserved for quarantine accommodation at Perseverance point.

General charts 1398, 1419, 825, 830, 70.

Plan 514, Port Blair. Var. 0° 20′ E.

Hospital (*Lat. 11° 45′ N., Long. 92° 40′ E.*).—The general hospital is on Ross island; all free persons are admitted at fixed fees.

Trade.—The principal export is timber; empties belonging to the Commissariat Department, canes and other jungle produce, edible bird's nests, and bêche de mer; the imports are goods and stores for the settlement, clothing, &c.

Chart 1419, Long island to Port Blair.

COAST.—From North point the coast trends northward, and is bold and straight for about 14 miles to Shoal bay; the land within it rises to a broken ridge, Koyob, about mid-distance of the length of the ridge, attaining a height of 1,505 feet.

Plan 839, Port Meadows and Kotára anchorage.

Shoal bay, a narrow inlet between the hills, extending westward for 3 miles and then southward for 7 miles, is fringed with mangroves, and the hills are clothed with fine forest trees, which are cut for export. There is a depth of 4 fathoms at its entrance, whence it rapidly shoals to 3 fathoms and one fathom.

Kyd island, northward of Shoal bay, is 780 feet high and rounded; a fringing reef which dries at low water, spring tides, extends for a distance of 3½ cables from its south-east point and 2 cables from its north-east extreme.

Kotára anchorage, the entrance to which is about half a mile in width, between the north side of Kyd island and Kotára point, extends for a mile in a westerly direction, and then turns northward for rather more than that distance; at its turn to the northward it is narrowed to nearly 2 cables between the fringing shoals on either side.

Depths.—The depths are from 4½ to 5 fathoms at the entrance, shoaling to 3½ fathoms at half a mile westward, and then increasing in depth to 4½ and 5 fathoms at the anchorage.

Anchorage for small vessels may be obtained in a depth of about 5 fathoms, over muddy bottom, about a quarter of a mile within the part of the port where it changes its direction to the northward; large vessels can find anchorage off Kotára point in from 7 to 10 fathoms water.

PORT MEADOWS, about 3 miles northward of Kyd island, is divided at its entrance into two passages, by Duncan or Entry island, inside which the port extends 2 miles in a westerly direction and opens out into two considerable sheets of water, in the southern of which there is limited anchorage, nowhere more than half a mile in breadth. The shores of Port Meadows have coral reefs extending off them, and the surrounding land is generally low, with extensive tracts of mangrove jungle, intersected by creeks, and forming several small islands.

Dangers.—The Patch, on which there is a depth of 3½ fathoms, fronts the southern entrance, and is 5½ cables south-south-east of the south point of Duncan island.

Whitehouse rock, about half a cable in extent, and on which the least depth is 2 fathoms, with 3½ to 10 fathoms around, is rather more than one mile eastward of Wedge point, and midway between is a shoal with 3 fathoms water over it, surrounded by depths of from 3¾ to 4¾ fathoms, except on the eastern side, where they are from 5½ to 9 fathoms.

Smyth rock.—*See* page 405.

Entrances.—The north-east point of a densely-wooded hill, which is separated from the main island by mangroves, forms the southern entrance point. A reef which dries at low water, spring tides, extends 4 cables from the southern part of the eastern side of the above hill, but from the north-east extreme it is distant only about one cable, and has some rocks which dry from 2 to 6 feet on it.

Duncan or Entry island (*Lat. 12° 1' N., Long. 92° 46' E.*), about 3 cables in extent, and 260 feet high, has a reef with rocks on it, one 18 feet high, extending from its south-west side, and the south channel into the port between these is about one cable in width.

The northern entrance, between the north side of Duncan island and Wedge point, the northern entrance point, is 3¾ cables wide, but narrowed to 1¼ cables by a reef extending northward of Duncan island and Wedge rock, 12 feet high, southward of Wedge point, and a fringing reef westward of it.

Depths.—The depths in the southern entrance are from 11 to 18 fathoms, and in the northern entrance 2 fathoms; in the harbour they are from 8 to 9 fathoms.

Anchorage may be obtained in from 9 to 10 fathoms water about 2¼ cables westward of the west point of Duncan island; there is also anchorage in a depth of 8 fathoms in the centre of the south-west part of the port.

Directions.—Steer for the south entrance point bearing W. by N., observing that the summit of Duncan island, bearing N.W., leads a quarter of a mile eastward of The Patch, and when Wedge point is shut in by Duncan island, N. 18° E., alter course to keep in mid-channel; at low water the rocks on both sides are uncovered.

Tides.—It is high water, full and change, at Duncan island, at 9h. 30m. (approximate); springs rise from 6 to 8 feet, neaps rise

Plan 839, Port Meadows and Kotára anchorage. Var. 0° 20′ E.

from 4 to 5 feet. From the few tidal observations made during the progress of the survey (1903) it appears that the Tide Tables for Port Blair are practically correct for Port Meadows.

Plan of Eastern entrance to the Andaman or Middle strait on 3145.

COAST.—From Wedge point the coast trends, in a northerly direction, for 1½ miles to South point, on the south side of Andaman or Middle strait, and is fringed by a shore reef, which extends for distances of from one cable to 2 cables. Rocks which dry 3 and 4 feet are situated off-shore northward of Wedge point, and a rock, one foot high, lies half a mile south-west of South point.

Smyth rock, a pinnacle with a depth of 2¼ fathoms over it, and from 3½ to 10 fathoms round, lies one mile eastward of South point.

Chart 1419.

ANDAMAN OR MIDDLE STRAIT (Godam Jura)

(*Lat. 12° 4′ N., Long. 93° 46′ E.*), entered between South and North points, nearly 2 miles apart, is a channel, about 18 miles in length, separating South Andaman island from Middle Andaman and Baratang islands; its general width is from 2 to 3 cables, but this is reduced in places to about 80 yards.

The water is generally deep throughout the narrow part of the strait, but one or two ridges, with a least depth of 3 fathoms, cross it; the bottom throughout is mud and sand.

Orol kaicha island, situated about half way through, where the trend of the strait changes from north and south to east and west, may be passed on either side, but the channel eastward and northward of the island has more moderate curves; near Spike island, at the western end of the strait, the bottom becomes foul (*see* page 431).

A steam vessel drawing 13 feet has passed through this strait.

Plan on 3145.

Eastern entrance.—Dangers.—A ledge of rocks, which dry at low water, extends for half a mile north-eastward of South point, and, westward of that point, the coast, for 1½ miles, is fringed by a bank of dead coral, mud, and stones, which extends in places for fully 2 cables.

A small, isolated, rocky ledge, 2 cables in length, in a north-west and south-east direction, half a cable in breadth, and having a conspicuous rock, 5 feet high, on it, lies half a mile east-south-east of North point.

A shoal about a cable in extent, with 1½ fathoms water over it, is situated 4 cables south of North point, and south-westward of the same point a coral reef, which dries in patches, extends for nearly 6 cables from the shore.

Plan of Eastern entrance to the Andaman or Middle strait on 3145.

Bar (*Lat. 12° 4′ N., Long. 92° 46′ E.*).—**Depths.**—The outer edge of the bar, which fronts the entrance, stretches from the extreme of the ledge off South point to the shore about 1¼ miles south-west of North point, and is from nearly half a mile to one mile in width, with general depths of from 1¾ to 2 fathoms over it.

Directions.—Entrance hill, about 2 miles south-west of North point, is a small, conspicuous, conical hill, 100 feet high, immediately over the north inner entrance point, and bearing W. by N. ¾ N., leads northward of the dangers on the south, while the same hill W. by S. ¼ S. leads to the southward of those on the north side.

The deep channel is only one cable in width, with shoal water extending from each shore, so that it is necessary to buoy the channel before entering; Entrance hill, bearing about West, appears to lead over the deepest part of the bar, and when at a distance of 4 cables from the hill the course should be altered more to the southward to round the point at a distance of about 2 cables to give the best water.

Tides.—It is high water, full and change, at 9h. 36m.; springs rise from 7 to 8 feet, neaps rise from 4 to 6 feet; neaps range from one foot to 2 feet.

Chart 1419, Long island to Port Blair. Var. 0° 20′ E.

THE ARCHIPELAGO which lies 7 to 18 miles off the east coast of Middle and South Andamans, and is separated from them by Diligent strait, extends from lat. 11° 46′ N. to lat. 12° 15′ N., and consists of 10 islands.

The islands are all densely wooded, practically uninhabited, except by a few Andamanese, who come over in the fine weather; water can generally be obtained by digging from 3 to 4 feet, and the islands abound in pigs and different kinds of pigeons.

Sir Hugh Rose island, the southernmost, situated 20 miles east-north-east of Ross island, is about 7½ cables in length in a north and south direction, 4 cables in width, and densely wooded; the highest part, 240 feet, is on the western side, and at the north-east extreme are conspicuous yellow cliffs, about 80 feet high.

The island is fringed all round by a reef, about a cable in width, and outside its eastern edge rocky ground, on which the sea breaks, extends for one cable.

Rocky ground, with a depth of 4½ fathoms, extends for 3 cables south-west of the south-west point, and gradually slopes to a depth of 10 fathoms, at one mile from the point. The southern side of the island should not be approached nearer than about 2 miles, to avoid an irregular-shaped 9-fathoms patch, which lies 2½ miles off its south-west point.

General charts 825, 830, 70.

Chart 1419, Long island to Port Blair. Var. 0° 20′ E.

The passage between Sir Hugh Rose island and Neill island should not be navigated, as the bottom is very uneven, with coral heads.

Neill island (*Lat. 11° 50′ N., Long. 93° 2′ E.*), about 2 miles north-westward of Sir Hugh Rose island, is 465 feet high at its north-eastern end, where there are conspicuous white cliffs rising abruptly from the sea; a rock about 20 feet high lies half a cable off this point.

The southern coast is low, partly bordered with mangroves, and fringed by a reef, on which the sea breaks heavily, extending from the southern point for a distance of 4 cables; a patch nearly one mile in length in a north-west and south-east direction, within the 5-fathoms contour line, and with a least depth of 3 fathoms over it, lies one mile off the south-west coast.

The south-west point, which is steep-to, has cliffs of dark colour and about 40 feet high.

The north coast is also fringed with reefs, with some foul ground and detached patches of 4¾ and 5 fathoms lying off it to a distance of half a mile.

Nankauri (Nancowry) strait, separating Neill and Havelock islands, has deep water and is safe for navigation, but vessels are advised to keep on the northern side of it to avoid a patch of coral of small extent, with a least depth of 7 fathoms over it.

Havelock island, the largest of the group, and situated 2½ miles northward of Neill island, is about 11 miles in length, in a north-north-west and opposite direction, and 2 to 5 miles in breadth. High white cliffs, about 90 feet high, form the southern extreme, and Sail rock, 20 feet high, which is detached from it about a cable, has, from some positions, the appearance of a sail.

On the south-western side are two small bays, and from Golung ma, the southern, a tidal creek has three branches extending in different directions inland.

The island is skirted by a coral reef, which, off the western side, extends about 2 cables, except near the entrance to Golung ma and southward of Yoto, where it is nearly double that distance from the shore; on the north-eastern side foul ground stretches out for about 2 miles, and the eastern approach to Tadma Juru requires great caution.

Pilot reef, on a bank fully one mile in length in a north and south direction, within the 5-fathoms contour line, has a least depth of 2½ fathoms over it, which lies 1²⁄₁₀ miles southward of Runnymede point, the south point of John Lawrence island.

Vibart shoal, 1¾ miles in length in a north-north-east and opposite direction, and 2 cables in width, on which there is a least depth of

9 fathoms, is narrow and steep-to on its eastern side; its northern extreme is situated 6 miles S.E. by E. of Runnymede point.

Tadma Juru (*Lat. 12° 2' N., Long. 92° 59' E.*), the narrow channel between Havelock and Sir William Peel islands, has deep water, and was much used during the survey.

Directions.—Entering from the south-eastward the western extreme of Sir Hugh Rose island just open of the eastern extreme of Neill island, bearing S. 8° E., leads eastward of Pilot reef and the foul ground north-east of Havelock island, and a N. 8° W. course should be steered with this mark astern, until the reef extending south of Runnymede point is seen, when course may be altered to the westward north of Pilot reef. *See* Rosamund shoal, below.

From the westward pass about 2 cables northward of Stowe point, the north extreme of Havelock island, steering East, until about 1½ cables off Sir William Peel island, when course should be altered to S.E. by E. ½ E., keeping in mid channel, and when approaching the eastern entrance to the strait, steer E. by N. ½ N. towards the reef skirting the south-west coast of John Lawrence island, westward of Runnymede point, which reef is steep-to and generally visible; keeping to the southward along its western edge, steering about S.E. by S., will lead northward and eastward of the dangers north-east of Havelock island.

Tadma bay, between the south-east part of Sir William Peel island, and the south-west side of John Lawrence island, affords good anchorage and shelter from the north-eastward.

Sir William Peel island (Ta-ērema), separated by narrow straits from the surrounding islands, is irregular in shape, low, and thickly fringed with mangroves.

Nicholson island (Kaichawa ērema), narrow and hilly, its northern summit being 390 feet high, is separated from Sir William Peel island by a channel a quarter of a mile in width, which can be used by launches. The northern and southern points are sharp, white, and conspicuous, with reefs extending off them.

The western side of the island is fringed by a steep-to reef extending from one cable to 2 cables, but from the southern point it stretches off about 3 cables and terminates in a shoal with 1¾ fathoms over it; off the northern end there is a depth of 3½ fathoms at a third of a mile northward of it.

Rosamund shoal, a narrow ledge of coral heads, nearly awash at low water, is about half a mile in length in a north-north-west and opposite direction, steep-to on its eastern side, and generally very difficult to distinguish; it lies between the south point of Nicholson island and the north-west point of Havelock island, is half a mile off Sir William Peel island, and on the northern side of the western entrance to Tadma Juru; the narrow channel north-eastward of the shoal should not be used when entering that strait.

Wilson island (Boroin-ērema) is separated by narrow channels from Nicholson and Sir William Peel islands on the south, and John Lawrence island on the east; it is nearly circular, about 2½ miles in diameter, and the summit, about a mile from its north-west point, is 710 feet high. The southern and eastern shores are thickly fringed with mangroves, and foul ground, strewn with coral heads, occupies the bay on the north side of the island.

Two Fathoms rock lies 1¼ miles north-north-east of the north-western point of Wilson island.

Clearing mark.—The northern point of Nicholson island open of the north-western point of Wilson island, bearing S. 12° W., leads a quarter of a mile westward of Two Fathoms rock.

John Lawrence island (Parkit-ērema) is 7¼ miles long in a north and south direction, about 2 miles broad, and about 500 feet high on its western side. Shoals and foul ground extend for about 1½ miles off its north-west coast, and rocky heads lie half a mile off Briton point, its northern extreme.

Minerva ledge, an isolated rocky patch, nearly one mile in length in a north and south direction, and about 7 cables in breadth, within the 10-fathoms contour line, lies about 5½ miles east-south-eastward of Runnymede point, the south end of John Lawrence island, and 4 miles westward of the 100-fathoms contour line. The least depth obtained on the ledge in 1907 was 3¾ fathoms at 5 miles south-south-east of the east extreme of Inglis island.

Kwangtung strait (*Lat. 12° 0′ N., Long. 93° 2′ E.*), separating John Lawrence island from Henry Lawrence island, is about 3 cables wide at its narrowest part, but the navigable channel is contracted to about half that width by reefs, and has depths of from 12 to 30 fathoms, the reefs skirting each side showing plainly.

Anchorage, with good shelter from the north-eastward, may be obtained, in a depth of 7 fathoms, off a sandy bay, immediately north-westward of Wreck point.

Henry Lawrence island (Chârka-ērema), eastward of John Lawrence island, from which it is separated by Kwangtung strait, is 7¾ miles long in a north and south direction, and about 3¼ miles broad. The western side of this island rises to a ridge

567 feet high, and is bordered by a narrow reef, on which are scattered mangroves.

The eastern side is low, with an irregular coast line, thickly bordered with mangroves, from which a fringing reef extends for a distance of a mile in places.

Inglis or East island (Jail-ērema) (*Lat. 12° 8′ N., Long. 93° 6′ E.*), three-quarters of a mile eastward of Henry Lawrence island, and separated by a channel about 2 cables in breadth, in which the depths are from 6 to 10 fathoms, is about one mile in length, three-quarters of a mile in breadth, and 190 feet in height.

Off its south and north-east points, small portions of the island have been detached by the sea, and at high water appear as small islets, but at low water are joined to the island by reef. A reef, which skirts all sides but the north-west, off the north-east point extends for half a mile; it is steep-to, and terminates in two rocks about 4 feet above high water.

A small thickly-wooded islet lies on the shore reef on the western side of the strait separating Henry Lawrence and Inglis islands; at low water the reef extends eastward of it.

Inglis patches are two patches of coral, the northern with a depth of 3¾ fathoms over it, lying three-quarters of a mile southward of the south point of Inglis island, and the southern, on which there is 4¾ fathoms, about one mile south-south-east of the other.

Outram island (Tár-mugu), of irregular shape, is about 3½ miles long in a north and south direction, 2½ miles wide, and 298 feet high on its west coast, just within the south-western point. Except on the western side it is surrounded by a shore reef, that off South point prolonged by a shoal on which there is a depth of 2 fathoms, extending for nearly a mile to the 5-fathoms contour line.

Off the east coast the reef extends generally for a distance of about 3 cables. Both the north and the south-west sides are indented, the former by Outram harbour, and the latter by a bight which is filled with reef; shoal water extends half a mile north-eastward of East and West points of Outram harbour, and the reef surrounding the latter point has low rocks on it.

Charka Juru, the strait separating Henry Lawrence from Outram island, is about one-third of a mile in width between the 5-fathoms contour lines, and has depths of from 11 to 29 fathoms. When using this channel care should be taken to avoid the coral heads and shoal water, which extend a mile south from South point of Outram island, and a mid-channel course will lead through the strait.

Chart 1419, Long island to Port Blair. Var. 0° 20′ E.

Outram harbour, on the north side of Outram island, extends nearly 1½ miles in a southerly direction, and is about three-quarters of a mile wide, but reefs fringe each side and nearly fill the inner half of the harbour.

Directions.—East and West points, which form the entrance, have shoal water extending about half a mile off them, which must be avoided, and when entering keep about a quarter of a mile off the eastern side, anchoring about a third of a mile within the entrance, in a depth of 10 fathoms, with the north end of Middle Button island in line with West point of Outram island, bearing N. 70° W.

Tides.—It is high water, full and change, at Ja-lebar, on the north-west coast of Havelock island, at 9h. 40m.; springs rise about 8 feet.

Tidal streams.—The tidal streams and currents were found to be most irregular during the survey, and to be considerably affected by the prevailing winds. The flood stream appears to set to the eastward through the different straits and channels, and heavy tide rips were observed through Nankauri strait, and off the north point of Sir Hugh Rose island, during a north-east wind.

North Button island (Chauga len jing), at the northern entrance to Diligent strait, and 3¼ miles northward of West point of Outram island, is three-quarters of a mile long in an east and west direction, narrow, 207 feet high, and terminates in low irregular cliffs at the eastern point, while its western part falls abruptly to a spit of sand covered with trees.

Shoal water extends about 9 cables eastward and 3 cables westward from the island, the eastern end of which should not be approached within 1½ miles, and the western end within three-quarters of a mile, in those directions.

Anchorage.—The northern side of the island is clear, but the bottom is rocky; there is good anchorage on the southern side close to the fringing reef.

Position (*Lat. 12° 18′ 56″ N., Long. 93° 3′ 20″ E., approximate*).—On the summit of the cliff on the southern side of North Button island is a station of the Great Trigonometrical survey of India, which is marked by a stone with a circle and dot, and is in the position given.

Shoals.—A shoal, about 6 cables in extent, with a least depth of 2 fathoms over it, lies 2$\frac{2}{10}$ miles north-westward of the western end of North Button island.

A shoal, 2½ miles in length in an east-north-east and opposite direction, and 3 to 6 cables in width, on which there are depths of from

Chart 1419, Long island to Port Blair. Var. 0° 20′ E.

2½ to 4½ fathoms, lies with its western end situated 3 3/10 miles north-westward of the western end of North Button island.

Middle Button island (Kaicha wa), 3 miles south-westward of North Button island, is half a mile long in a north-east and south-west direction, about 2 cables broad, and 164 feet high; the northern end is cliffy, but the south-western point terminates in a short sand spit, with a few low rocks off it.

A ridge of rocks and shoal water extends 1 4/10 miles south-westward from the island, and shoals with depths of 2½ to 4½ fathoms extend north-north-eastward for a distance of 1½ miles from the northern end of Middle Button island.

Clearing marks.—The whole of North Button open eastward of Middle Button, bearing N. 37° E., leads eastward of the shoal ground extending south-westward of the latter island.

Anchorage (*Lat. 12° 16′ N., Long. 93° 1′ E.*).—There is good anchorage southward of Middle Button island, in a position clear of shoals.

South Button islet (Agga lod baraij), 3 miles southward of Middle Button island, is circular in shape, about a cable in diameter, 118 feet high, and formed of large rocks steep-to all round. A coral patch, with 1¾ fathoms water over it, lies one mile S.E. by S. of South Button islet; and a rocky head, with 5½ fathoms on it, lies one mile eastward of that islet.

BARATANG ISLAND, separated from South Andaman island by Andaman strait, and from Middle Andaman island by Homfray strait, is about 15 miles in length in a north and south direction, and 3 to 8 miles in breadth. The coast, from the eastern entrance of Andaman strait, trends north-north-eastward for 13 miles, and is deeply indented with bays and inlets, in which anchorage may be found, except during the South-west monsoon, when there is probably a heavy ground swell. The land is hilly, and the coast line is fronted by mangroves, growing on reef.

From a point of Baratang island at about 8½ miles north-eastward of Andaman strait entrance, a chain of islands (of which Strait island is the southernmost), reefs and rocks, extends northward for about 15 miles. The islands are separated from each other and from Baratang island by narrow channels; the bays and inlets formed by the islands are full of shoals and intricate, but shelter might possibly be found.

Plan on 3145.

Strait island, the south point of which is 3¼ miles north-north-westward of Wilson island, is 1¾ miles long in a north and south

Plan on 3145.

direction, about three-quarters of a mile wide, and 380 feet high. Its southern end terminates in a narrow point, with shoals of 2¾ to 4½ fathoms extending 4 cables south-south-westward of it.

Foul ground and shoals with depths under 5 fathoms extend 2 miles off the eastern side of Strait island, and the area between its north end and the south-east side of North Passage island is shoal; vessels of deep draught should not approach Strait island on south-westerly bearings within a distance of 3 miles.

Anchorage (*Lat. 12° 13′ N., Long. 92° 55′ E.*) may be obtained in a depth of 10 fathoms about one-third of a mile north-westward of the south point of Strait island.

Chart 1419.

DILIGENT STRAIT lies between Wilson island, South Button island, and Outram island on the south-east, and Strait island, Middle and North Button islands on the north-west; the least water to be passed over in its fairway is 6 fathoms, south-eastward of Strait island.

Directions.—From the southward, steer for Strait island until the southern side of South Button islet is in line with the north-western extreme of Outram island bearing N. 55° E.; keep that mark on until the eastern extreme of Middle Button island bears N. 22° E., when alter course to pass north-westward of South Button islet and midway between Middle and North Button islands and Outram island.

From the northward, and being about 2 miles eastward of North Button island, steer to pass half a mile north-westward and westward of South Button islet, then bring the southern side of that islet in line with the north-western extreme of Outram island, bearing N. 55° E., and steer S. 55° W., using it as a stern mark until the northern point of Nicholson island opens westward of Wilson island, S. 12° W., when alter course to pass about a mile westward of Wilson island.

Tides.—It is high water, full and change, at Strait island at 9h. 31m.; springs rise 7½ feet, neaps 5½ feet, and neaps range 3½ feet. It is low water about half an hour later than at Port Blair.

Tidal streams.—In Diligent strait the tidal streams are weak, but with strong southerly winds there probably is a considerable northerly set in the narrows.

Colebrooke island (Pich laka chakan), lying nearly one mile north-westward of Strait island, is very irregular in shape, about 2½ miles long in an east and west direction, and 285 feet high at its north-west side; it is separated from Baratang island by Colebrooke passage, about 2 cables in width with depths of from 5 to 8 fathoms except at its northern part, which is shallow.

Plan of Elphinstone harbour on 3145. Var. 0° 20′ E.

Anchorage (*Lat. 12° 12′ N., Long. 92° 52′ E.*), well sheltered and with good holding ground, has been obtained in a depth of 8½ fathoms at the southern end of Colebrooke passage, with the south-eastern extreme of Colebrooke island in line with the centre of Middle Button island, bearing N. 63° E.; the space available, with a depth of over 3 fathoms, being about 2½ cables in diameter.

North Passage island (Toba ērema), nearly 5 miles in length in a north and south direction, is also very irregular in shape and of varying breadth; it is 492 feet high at its eastern end, and lies about two-thirds of a mile northward of Strait island. All the eastern side of this island is foul ground, with coral heads and patches extending from one mile to 2¼ miles eastward of its south-east side; this uneven ground joins that eastward of Strait island.

The north point is formed by a narrow promontory, which projects about 1½ miles, and nearly a mile westward of, and parallel to, it is Balfour reef, which extends about one mile northward of the island; Merk bay, between these, extends 1½ miles to the southward, has a width of about 6 cables for about one mile, and depths of from 13 to 15 fathoms.

Nancowry ledge, nearly half a mile in length, in a north and south direction, and with less than one fathom water over it, lies 1¼ miles northward of the north point of North Passage island, and is on the extreme of a narrow shoal, with depths under 10 fathoms, which stretches to the southward from Long island.

Guitar island (To-lé-té-lé).—Cape Dalrymple, the south point of Guitar island, is situated 1¼ miles west of the south extreme of Nancowry ledge, and from it Guitar island stretches for 1$\frac{4}{10}$ miles in a northerly direction, and is 330 feet high near its northern end.

A fringing reef and foul ground extends about a quarter of a mile from the east side of the island, and a shoal, on which there is a depth of 2 fathoms, lies with its south extreme 7 cables in a south-south-east direction, from Dalrymple point, with depths of 3½ and 4½ fathoms between it and the shore reef. A 5-fathoms patch lies about 3 cables farther to the southward.

Round island, about one cable westward of Guitar island, is 2 cables long, one cable broad, and 155 feet high.

ELPHINSTONE HARBOUR, formed by the northern part of the channel which separates North Passage island from Baratang island, is about 2 miles in length in a southerly direction, and in that part not encumbered with reefs or shoals is nearly three-quarters of a mile square.

General charts 1398, 1419, 825, 830, 70.

Plan of Elphinstone harbour on 3145. Var. 0° 20′ E.

The entrance, between Balfour reef and the north-west point of North Passage island, on the east, and a detached reef, which lies three-quarters of a mile off the north-east end of Baratang island, on the west side, is about half a mile in width. A shoal, with a depth of 4½ fathoms over it, lies a quarter of a mile south-eastward of the detached reef on the west side of the entrance, and about three-quarters of a mile further south, is another detached reef, which, with a shoal with a rock awash on it, on the east side of the harbour, contract the width to half a mile.

Depths.—The depths are about 11 fathoms in mid channel of the entrance and of the harbour.

Homfray strait (Chara Juru) (*Lat. 12° 18′ N., Long. 92° 52′ E.*).—The eastern entrance to Homfray strait is on the western side of that to Elphinstone harbour; the outer edge of the bar of the strait, close to the detached shoal already mentioned, is 6 cables in width between reefs which project from the mangroves on either side.

Depths.—The bar is about 1¼ miles across, with depths of from 1½ to 3 fathoms over it, and within it are depths of from 4 to 5½ fathoms; it is said that there is not less than 2¾ fathoms in the strait, after the bar is crossed. *See* page 434.

Directions.—No directions are given for Elphinstone harbour, or for the bar of Homfray strait, but the conspicuous tree, on the hill, 388 feet high, on the north side of the latter, bearing W. ¼ N., will probably lead in mid-channel between the north point of North Passage island and Nancowry ledge, and bearings of the same tree lead either north or south of the 5-fathoms patch in mid-channel between the extreme of Balfour reef and the shoal southward of Cape Dalrymple.

Entering Elphinstone harbour, a mid-channel course should be kept between the north-west point of North Passage island, and the detached shoal north-eastward of Baratang island.

Tides.—It is high water, full and change, in Elphinstone harbour, at 10h. 0m.; springs rise from 7 to 8 feet; neaps rise from 5 to 6 feet.

Plan 3145; chart 1419.

Long island (Ma-i-tang), two-thirds of a mile north-north-east of Guitar island, extends for 4¾ miles in that direction, from Cape Smith, its south point, and has a general width of one mile; it is densely wooded, and 435 feet high at its north-western side.

Reefs and shoal water extend for about a third of a mile, in places, off its south, east, and north sides, but the western coast is joined to

Plan of Elphinstone harbour on 3145. Chart 1419.

Middle Andaman island by a shallow flat, on which the depths are generally less than one fathom.

The channel which divides it from Guitar island, extends with depths of from 3½ to 7 fathoms, for a distance of 3½ miles in a north-north-west direction, forming the entrance to several creeks which branch out into Middle Andaman island.

Osmaston shoal, situated 1¾ miles eastward of Cape Smith, is about 1½ cables in length in an east and west direction, and a cable in width, with 2½ fathoms water over it.

Chart 1419, Long island to Port Blair. Var. 0° 20′ E.

Headlam patch, nearly circular, and about a quarter of a mile in diameter, has a least depth of 2 fathoms, the shoal water surrounding it, with depths under 10 fathoms, being about three-quarters of a mile long and half a mile wide; it lies nearly 3 miles north-north-east of Osmaston shoal, and 1$\frac{4}{10}$ miles off the east side of Long island.

Anderson rock, which dries one foot, lies one mile eastward of the north point of Long island, on a shoal about one mile square, with depths under 10 fathoms.

Campbell shoal, 5$\frac{8}{10}$ miles eastward of the north point of Long island, is about 2 cables in length in a north and south direction, fully a cable in width, with a depth of 3 fathoms over it, and lies on the eastern side of a bank, about 2½ miles in length in a north and south direction, with depths under 20 fathoms.

Rong-at bay (*Lat. 12° 28′ N., Long. 92° 57′ E.*).—A point, on Middle Andaman island, 535 feet high, forms the south side of Rong-at bay, the north entrance point being 290 feet high. These are both bold bluff points: the southern, excepting a reef which extends half a mile southward of it, is comparatively steep-to, but the northern point has a shoal stretching fully 2 miles eastward of it, with a patch of 4 fathoms near its extreme, and a rock that dries 4 feet, half a mile off the point.

The anchoring space within the points is about 6 cables square, with depths of from 3½ to 5 fathoms; inside it expands to 2 miles in width, but is quite shoal with reefs that dry and mangroves.

Chart 825, Andaman islands.

COAST.—From Rong-at bay the coast trends for a distance of 13 miles in a northerly direction to Cuthbert bay, and is high; at 3 miles westward of Cuthbert bay is a peak, 1,678 feet, and from this the coast, still continuing high, trends rather to the westward of north for 9 miles to Kinserley point.

General charts 830, 70.

Plan 2455, Stewart sound. Var. 0° 20′ E.

STEWART SOUND, which lies between Kinserley and Cadell points, 11 miles apart in a north-north-east and opposite direction, is fronted by Sound island, which occupies nearly a central position between these points; the Sound recedes for a distance of about 6 miles, with several small bays, of which Bacon bay is the only one recommended for anchorage.

White mountain (*Lat. 12° 51′ N., Long. 92° 53′ E.*), 2 miles westward of Kinserley point, is 1,184 feet, Ray hill, on a promontory, which forms the northern side of Bacon bay, is 445 feet, and a hill about 2 miles west-north-west of Cadell point is 720 feet high, and these, with other hills surrounding the Sound, are densely covered with jungle. At the head of a shallow bay, on the southern side of the Sound, is the entrance to Austin strait, separating Middle and North Andaman islands.

Sound island, very irregularly shaped, is 4½ miles in length between its south extreme and North point, and 482 feet high about one mile south-westward of the latter.

Ridges of high land traverse the island in all directions, and are prolonged in spurs to the points of the bays, which indent it; the coasts are fringed with a belt of mangroves, and surrounded by coral reefs, with occasional sandy beaches.

Square rock, 14 feet high, and 1½ cables southward of the south point of the island, on the reef extending from it, is a useful mark when entering the Sound. Jones point, the south-west extreme of the island, has a reef extending 3½ cables southward of it, on which is a ridge of rocks which terminates in one that dries 8 feet: the western side of the point is steep-to.

North point has rocks extending from it for a distance of 4½ cables in a north-east direction.

Landing.—Good landing may be effected in a small sandy bay on the south-east side of the island.

Convict patch, 1$\frac{1}{10}$ miles northward of Kinserley point, is 7 cables in length in an east and west direction, and has rocks on it with less than one fathom water over them; its eastern end is about 1⅓ miles from the shore westward of it. A 6-fathoms patch lies about 1½ miles south-eastward of Convict patch.

Five fathom patch, of sand and coral, half a mile in length in a north and south direction, and 3 cables in width, within the 10-fathoms contour line, has a least depth of 5 fathoms over it, and lies 1¾ miles north-eastward of Convict patch.

Aves island, about 4 cables in extent and 207 feet high, is connected with Aves point, westward of it, by a coral reef which dries in

General charts 825, 830, 70.

places at low water, spring tides; the island is easily recognised from seaward.

Kwangtung point (*Lat. 12° 56′ N., Long. 92° 53′ E.*), the southern entrance point to Bacon bay, and the eastern point of the bay, at the head of which is Austin strait, is 213 feet high; northward and westward of this point is the Berkeley group of islands, comprising Orchid, Curlew, Egg, and Dottrel islands, the three first being 157, 150, and 60 feet high, and lying across the entrance to Bacon bay.

A shoal with a depth of 2½ fathoms over it, lies 7 cables south-south-east of the south-east point of Orchid island, and that point has a reef extending 1½ cables from it, but otherwise the island is steep-to.

Marsack shoal, two small coral patches, lying between Jones and Brown points, are about a third of a mile apart, the eastern having a depth of 3½ fathoms, and the western, which is 8½ cables west-north-west of Jones point, a depth of 1½ fathoms over it.

Bacon bay, about 2 miles in length in a north and south direction, and 1½ miles in width, is entered between Orchid island and Brown point, the entrance being about half a mile wide; it forms a large and excellent harbour, completely sheltered from all winds.

Depths.—There are depths of from 11 to 17 fathoms in the entrance, and from 12 to 14 at the anchorage.

Directions.—Approaching Bacon bay from the southward, Ray hill should be brought just open of Jones point, bearing N. 38° W., and steered for until Aves island bears W. ½ S., when Orchid island will be seen about midway between Aves island and Jones point, and course should be altered for it, and when Aves island bears S.E. steer N.W., with it astern, passing in mid-channel between Orchid island and Brown point, and then keeping to the northward for the anchorage at the head of the bay.

Coming from the northward, and intending to enter by the south entrance, Square rock should be rounded at a distance of 6 cables, and when Orchid island is seen midway between Aves island and Jones point, follow the directions given above.

Stewart island, situated in a shallow bay on the north-west side of Stewart sound, is 2¼ miles in length in a north-west and south-east direction, 1½ miles in breadth; it is covered with dense jungle, and joined to North Andaman island by a mud bank at low water, spring tides.

Sunk rock, 2 miles E. by N. ½ N. of Monkhouse point, dries 2 feet and has a patch of 3 fathoms close north-west of it. A group of rocks, uncovering 8 feet at low water, spring tides, lie half a mile

Plan 2455, Stewart sound. Var. 0° 20′ E.

south-westward of Sunk rock, and have shoal water extending nearly a quarter of a mile south-west of them.

Oyster islet, 4 feet high, is nearly 8 cables southward of Sunk rock.

Oliver island (*Lat. 13° 0′ N., Long. 92° 58′ E.*), one mile westward of North point of Sound island, is about 2 cables in extent and 195 feet high; its east and north sides are fringed by a reef, extending one cable from the latter, but the south-west part of the island is steep-to, and there is a deep-water channel between it and Sound island.

Morland rock, situated 4 cables south-west of Cadell point, uncovers 8 feet at low water, spring tides; shoal water, with a depth of 2½ fathoms, extends 3 cables south-south-east of the rock.

Elfin patch, a coral shoal, 3 cables in length in a north-east and opposite direction, and one cable in breadth, has less than one fathom water over its centre, which is one mile south-east of Cadell point.

Anchorage may be obtained in almost any part of Stewart sound, but, as previously stated, Bacon bay is the only anchorage recommended.

Tides.—It is high water, full and change, in Stewart sound at 10h. 5m.; springs rise 8 feet, neaps rise 6 feet.

Tidal streams.—The flood stream sets to the northward and the ebb to the southward, attaining a velocity of 1½ knots at springs, in the narrow parts of the Sound. Southward of Camp bay the flood has a rate of a quarter of a knot, the ebb attaining a velocity of 2 knots.

Water.—Springs of fresh water are situated near the shore of Middle Andaman island, about 3 miles southward of Aves island, also at Camp bay, but only a small quantity can be obtained during the dry season from either of these places, and, at that period, none is obtainable on Sound island.

Chart 825, Andaman islands.

NORTH ANDAMAN ISLAND.—East coast.—From Cadell point the east coast of North Andaman island trends to the north-eastward for a distance of 3 miles to Tara lait, a small bay, and then to the northward for 12 miles to Dundas point, at the southern side of Port Cornwallis; this coast affords no landing.

Saddle hill, a mountain 2,402 feet high, and the highest part of the Andaman islands, is situated about 10 miles northward of Sound island; Saddle North peak, 2,247 feet high, lies 2¼ miles further

Chart 825, Andaman islands. Var. 0° 20′ E.

northward; they are covered with vegetation, and on easterly or westerly bearings form two peaks with the appearance of a saddle.

Craggy island, 9 miles northward of Tara lait, is small and connected to the shore by a reef, on the southern side of which there is good anchorage in depths of from 4 to 10 fathoms. The land near Craggy island is apparently thickly populated.

Plan 2986, Port Cornwallis.

PORT CORNWALLIS, entered between Dundas point and Bopung island, extends, with several changes in direction, for 8 miles in a north-west direction; dense belts of mangroves line the shores, and on its south-west side are Atalanta and another bay, and on the north-east side Minerva and an unnamed bay. Brush islet occupies the centre of the channel inside the entrance, and Chatham island is situated on the western side of the port, with North and South islands northward of it.

Dundas point, on the south side of the entrance, is a sharp rocky point rising to 426 feet at half a mile southward of its extreme; Middle reef, awash at high water, is situated half a mile south-south-east of the point.

South reef, awash at high water, is 4 cables eastward of Dundas point, with shoal patches between, and a narrow shoal, steep-to, with depths under 5 fathoms, extends a third of a mile north-eastward of South reef.

Bopung island, connected by a sandy spit with the land eastward of Hood point, about 3 cables north-westward, is surrounded by a reef, which, with shoal water, extends 4½ cables eastward and nearly 3 cables southward of it. North reef, situated on the edge of the 10-fathoms contour line, is awash at high water, and lies 3¾ cables south-eastward of the island.

Entrance.—Depths.—The entrance between Dundas point and Bopung island is 1$\frac{4}{10}$ miles in width, but is narrowed to a little less than one mile between the 5-fathoms contour lines surrounding the dangers on each side; the depths in the entrance channel are from 10 to 20 fathoms, shoaling to 7 fathoms at the anchorage.

South-west side.—Atalanta bay.—Rocky point lies 1¼ miles west-north-westward of Dundas point, with Atalanta bay between them, in the entrance to which there is good anchorage during the South-west monsoon; a rocky patch of 3¼ fathoms lies 9 cables westward of Dundas point, in the centre of the bay.

Brush islet (*Lat. 13° 18′ N., Long. 93° 2′ E.*), the tops of the trees on which are 51 feet high, is surrounded by a reef and situated nearly in mid-channel at three-quarters of a mile northward of Rocky point. A shoal 6 cables in length in an east and west direction, with depths under 5 fathoms, has a rock with a depth of 3 feet over it, at its western end, situated nearly 9 cables westward of the islet.

A patch with a depth of from 7 to 9 fathoms, over mud, lies nearly a mile northward of the islet, on the line of the leading mark.

Chatham island, the south point of which lies $1\frac{3}{4}$ miles west-north-west of Brush islet, extends thence northward $1\frac{6}{10}$ miles, and is from 2 to 4 cables in breadth; it is about 200 feet in height, and covered with jungle.

North-east side.—Perseverance point.—Hood point is 4 cables north-west of Bopung island, with a small shallow bay between, and Perseverance point, $1\frac{8}{10}$ miles further in the same direction, is 318 feet high, with depths of 7 to 12 fathoms at a cable off it.

Minerva bay, situated between the points, has depths of from 12 to 13 fathoms in the centre, but a rocky patch, with from 6 to 8 fathoms over it, extends about 7 cables south-eastward of Perseverance point across the entrance of the bay.

Low islet, about 40 feet high, is situated about a mile northward of Perseverance point.

North island (*Lat. 13° 21′ N., Long. 93° 1′ E.*), half a mile northward of Chatham island, is about half a mile long, in a north and south direction, $1\frac{1}{2}$ cables wide, and 277 feet high. Wharf islet, 159 feet high, and South islet, 119 feet high, are situated westward of the southern part of North island.

The western part of the harbour is very shallow, but a narrow channel, with not less than 3 fathoms, passes between Wharf and South islets, and turns south-westward into an extensive and very shallow backwater, surrounded by mangroves.

Anchorage.—The best anchorage is north-eastward of Chatham island in depths of from 6 to 8 fathoms, over mud.

Directions.—Enter the harbour with South point, Chatham island, in line with Brush islet, bearing N. 74° W., until the western extreme of Wharf islet is in line with the northern extreme of Chatham island, N. 49° W., which mark leads up the harbour; when abreast Perseverance point steer to the northward for the anchorage about midway between Chatham island and Low islet.

Tides.—It is high water, full and change, in Port Cornwallis at 9h. 50m.; springs rise 8 feet, neaps $5\frac{1}{2}$ feet; neaps range 3 feet.

Supplies.—A few natives who are quite friendly live on the shores of the harbour, and generally bring off fish to a vessel, which they will exchange for tobacco, biscuit, or calico; there are some beds of

Plan 2986, Port Cornwallis. Var. 0° 20′ E.

good oysters. There is an abundance of fresh water, and about 6 cables above Perseverance point is a spring.

Climate.—The climate of the port was supposed to be unhealthy, but there appears reason to doubt this, as, during the survey, a party remained on Chatham island for a month without any sickness occurring.

BACK BAY (*Lat. 13° 19′ N., Long. 93° 5′ E.*) lies between Bopung island and Mangrove point, a bluff point 2¼ miles northward.

Back bay reef, situated about 1¼ miles north-north-east of the eastern end of Bopung island, dries 5 feet; except when the sea is very smooth, it is generally visible at high water.

One fathom shoal, lying one mile south-eastward of Mangrove point, is 3 cables in length, in a north-east and south-west direction, and 2 cables in width, within the depths of 10 fathoms; the least depth on the shoal is one fathom, and the sea only breaks on it in heavy weather. The 20-fathoms contour line passes about a quarter of a mile eastward of the shoal.

Clearing marks.—Hand peak, a sharp wooded hill, 719 feet high, south-westward of Rocky point, in line with the southern end of Bopung island, bearing S. 54° W., leads south-eastward of One fathom shoal, and Tree islet in line with Cape Price, N. 20° W., leads eastward of it.

Chart 825, Andaman islands.

Turtle islands, 2 miles north-north-westward of Mangrove point, are small, wooded, and 150 feet high; a fringe reef surrounds each of them, and there is a sandy beach on the northern side of the south-western island. Turtle reef, with a sandbank 4 feet high in the middle, lies half a mile northward of the islands; and a shoal with 4 fathoms water over it lies east-south-eastward half a mile from Turtle reef.

There is a clear passage, from 3 to 4 cables wide, with a depth of not less than 11 fathoms between Turtle islands and the main island.

Thararo, a small wooded islet, lies at the entrance of a shallow channel leading to Port Cornwallis; a shelving reef extends 2½ cables from its eastern side. A rocky ledge, awash at high water, lies 3½ cables eastward of Thararo.

Chart 3103, North part of North Andaman island.

TABLE ISLANDS are two islands covered with high trees.

Chirume, the southern of these islands, is nearly circular, 6 cables in extent and about 200 feet in height; on its eastern and southern

Chart 3103, North part of North Andaman island. Var. 0° 20′ E.

sides there are mangroves and on the north-western a clear sandy beach.

The shore reef extends about 4 cables southward of the island, which lies on the south-west part of a shoal nearly 2¼ miles in length, in a north and south direction, and 1½ miles in width; this shoal extends 1$\frac{2}{10}$ miles eastward of the north end of Chirume island.

Excelsior, the northern of these islands, lying about three-quarters of a mile north-north-eastward of Chirume, at the northern part of the shoal just mentioned, is half a mile long, in a north-west and south-east direction, 3 cables broad, and 180 feet high.

The shore reef extends about 3 cables from its north-east side; on its south-western side there is a sandy beach which is steep-to; both islands are comparatively steep-to on their western sides, but foul ground with dangers extends 1¾ miles eastward of them, or to the 10-fathoms contour line.

Table and Mushroom reefs, the most noticeable of these dangers, lie within half a mile of each other at about 1½ miles east-south-eastward of Chirume; they dry 4 feet and generally show.

A patch, with 2½ fathoms water over it, lies nearly a mile north-eastward of Excelsior island.

In passing this vicinity the water should not be shoaled to less than 20 fathoms, that depth being found at about 2 miles from Table islands.

Chart 825, Andaman islands.

South Passage reef, in the southern entrance to the passage between Table islands and the main island, is small and covered at high water, spring tides, and should be passed on its western side, as shoal water extends 4 cables east-south-eastward of it.

Chart 3103, North part of North Andaman island.

North Passage reef, about half a mile westward of Excelsior island, is awash at high water, spring tides, and always shows.

Trilby island (*Lat. 13° 26′ N., Long. 93° 4′ E.*), about a mile in length in a north and south direction, a quarter of a mile in width, and 257 feet in height, lies off the eastern entrance point to Cadell bay at about a mile westward of Chirume island.

Tree islet, rocky, 45 feet high, with some low trees on it, lies 3 cables east-north-eastward of the northern point of Trilby island, the passage between being foul, with a rock, which dries, in mid-channel. There is a clear passage between Tree islet and North Passage reef.

General charts 825, 830, 70.

Chart 3103, North part of North Andaman island. Var. 0° 20′ E.

Bond harbour, south-westward of the south extreme of Trilby island, is sheltered, except from northward, and affords good anchorage in depths of from 7 to 8 fathoms, over sand and mud, in the middle of the harbour with Tree point bearing East.

Cadell bay, lying westward of Trilby island, and a projecting point of North Andaman island, has good anchorage in depths of from 6 to 7 fathoms, over mud, in the South-west monsoon.

Beauchamp reef, 1¾ miles north-west of the north point of Trilby island, and nearly a mile off-shore, is about 3 cables in length in a north and south direction, and is awash.

Coast.—From abreast Beauchamp reef the coast trends northward for a distance of 7½ miles to Cape Price, and, having several rocky patches lying off it, should not be approached within 2½ miles; good landing may be effected on several parts of this stretch of coast. The most outlying danger is a rock with 3 fathoms water over it, and surrounded by depths of from 4 to 6 fathoms, which lies $1\frac{2}{10}$ miles off-shore at $2\frac{6}{10}$ miles northward of Beauchamp reef. Two miles farther north, and nearly a mile off-shore, is a 3¼-fathoms patch.

Pocock island, 1½ miles south-eastward of Cape Price, is 244 feet high and wooded. Half a mile southward of the island is a rock which dries 4 feet, and the passage inside the island should not be used.

UNION LEDGE (*Lat. 13° 32′ N., Long. 93° 11′ E.*), nearly awash at low water, and situated 6½ miles eastward of Pocock island, forms the southern limit of an extensive bank of soundings with uneven bottom, which extends south-eastward of East island. A patch with from 6 to 8 fathoms water over it lies three-quarters of a mile eastward, and a 3-fathoms patch lies about 4 cables south-westward, of the ledge.

Cape Price, the northern point of North Andaman island, is densely wooded and slopes gradually to the sea; from it the coast, which is much indented, densely wooded, and generally fringed with mangroves, trends, with two large indentations, west-south-westward about 7 miles to Cape Thornhill.

One fathom patch, lying 6 cables northward of Cape Price, is about 2 cables in extent, with 4½ to 6 fathoms between it and the cape; it breaks in heavy weather.

EAST ISLAND, 2¾ miles north-north-eastward of Cape Price, is 2¼ miles long in a north-north-east and opposite direction, 6½ cables broad, and 243 feet high. A few oceanic teal frequent the lagoon on this island, which also abounds with the small Andamanese pig.

General charts 825, 830, 70.

Chart 3103, North part of North Andaman island. Var. 0° 20′ E.

Shoals with depths under 5 fathoms extend 2 miles north-westward of the north end of the island.

Tides.—It is high water, full and change, at East island at 9h. 30m; springs rise 8 feet, neaps 5 feet; neaps range 3 feet.

LANDFALL ISLAND, about 7 cables westward of East island, and separated from it by a channel with a depth of 3 fathoms, but so narrow as to be only suitable for boats, is 3½ miles long, in a north-west and south-east direction, 2 miles broad, and 260 feet high at its northern end. A few Andamanese, encamped on the island in 1896-98, were friendly, and brought off fish in exchange for biscuit.

Landfall rocks, off the south-east end of the island, are 42 feet high, and conspicuous.

CLEUGH PASSAGE (*Lat. 13° 36′ N., Long. 93° 0′ E.*), between North Andaman island and East and Landfall islands, is navigable, but owing to the numerous shoals in it, for which no clearing marks can be given, and the strong tidal streams, it should not be used. The general depths in the passage are from 11 to 31 fathoms, but several patches, with from 5¾ to 10 fathoms water over them, are scattered all over it.

Cleugh rocks, about 1½ miles south-south-westward of the south-western point of Landfall island, form a reef, half a mile long in an east and west direction, and about 3 cables broad, the western part of which, awash at high water springs, is visible; there are depths of from 2¾ to 9 fathoms around the rocks.

Passage rock, about half a mile south-eastward of Cleugh rocks and nearly in the middle of the passage, is small and dries 4 feet; there is deep water around it.

The passages northward of Cleugh rocks, or between them and Passage rock, should not be attempted.

Tidal streams.—In Cleugh passage, the flood stream sets about east-south-east and the ebb west-north-west, the rate at springs being about 1½ knots. Tide rips occur over nearly the whole of the passage.

Jackson ledge, on which the least depth found was 1¾ fathoms, is a quarter of a mile long in a north-west and south-east direction, and rather over a cable wide, and situated 3¼ miles eastward of the north-eastern point of East island; tide rips occur in its vicinity, but it has not been seen to break.

Ranger reef, with a least depth of one fathom over it, is about a cable in extent, and lies 2 miles eastward of the north-eastern point of East island, with 5-fathoms patches a half and three-quarters of a mile northward of it. The sea breaks on the reef in heavy

General charts 825, 830, 70.

weather, but it cannot be seen, even from aloft, at other times; tide rips occur in its vicinity, and between it and the northern point of East island.

Hickman shoal (*Lat. 13° 42′ N., Long. 92° 59′ E.*).—An area of shoal water, with depths under 10 fathoms, extends 1½ miles north of the north end, and 2½ miles north and north-west of the north-west extreme of Landfall island; Hickman shoal, near its north-west extreme, consists of two patches of 4½ and 4¾ fathoms, the southern and shoaler being 1½ miles northward of the north-west end of the island.

Between Hickman shoal and the island, and eastward of the shoal, are several patches with depths of from 2¾ to 5½ fathoms.

WEST ISLAND, 1¾ miles long in a north-north-east and opposite direction, three-quarters of a mile broad, 178 feet high, and thickly wooded, is fringed by a reef and shoal which extends from 3 to 3½ cables from the north-west and north sides, respectively, and a shoal of 4¾ fathoms lies half a mile south of its southern end, which is situated about 3 miles north-westward of Cape Thornhill, with deep water between. The north and south ends of the island should not be approached to a less distance than one mile.

Thornhill island, separated from Cape Thornhill by a channel a cable in width, with a depth of 2¼ fathoms in it, is nearly circular, 4 cables in diameter, and 254 feet high. A reef, with rocks on it 3 feet high, lies two-thirds of a mile north-eastward of Thornhill island, and the same distance off-shore.

Whitecliff island, 110 feet high, lying 1½ miles westward of Thornhill island, with deep water between, is 3½ cables long in a north-north-west and opposite direction, 2½ cables broad, and its northern end has cliffs 60 feet high and dark in colour; except at this part it is surrounded by a reef, extending 2 cables round its southern part; the island should not be approached nearer than half a mile.

Caution.—Although the shoals about the northern end of the Andaman islands have been examined, there is a possibility that less water may exist over them than has been found and is shown on the chart; also the shoals are not always visible from aloft, and vessels should not attempt to pass over any shoal shown on the chart in this locality.

Chart 825, Andaman islands.

WEST COAST.—The west coast of the Andaman islands has coral reefs more extensive, and extending to a far greater distance from the land, than those on the east coast, shoal patches being found at distances of from 20 to 25 miles from the land. The highest land of the Andaman islands, which consists of hills covered with luxuriant vegetation, is on the eastern side, and gradually descends towards the western side, where marshy localities abound.

The western side of the islands is exposed to the South-west monsoon, in which season especially it should not be approached, and at any time it is by no means a desirable locality.

Mountains and hills.—The most conspicuous summits between Cape Thornhill and Shark islet are:—Taylor hill, 644 feet high, a long ill-defined summit 6¼ miles south-south-east of Cape Thornhill.

D'Oyley peak (*Lat. 13°·24′ N., Long. 92° 53′ E.*), 522 feet high, very sharp, 8 miles south of Cape Thornhill.

Tuson hill, 790 feet high, three summits of nearly the same height and only a slight dip between them.

Tradikeli hill, 1,110 feet high, a sharp ridge with a peak at its southern end, 17 miles southward of Cape Thornhill and eastward of Casuarina bay.

Saddle North peak, 2,247 feet high, a flat top with a sharp peak at its northern end, 23 miles southward of Cape Price.

Saddle hill, 2,402 feet high, a rounded summit, about 2½ miles southward of Saddle North peak; all the above are some distance from the west coast. The following coast hills are noticeable: Brown's hill, 300 feet high, about a mile south-east of Cape Thornhill; Jessop hill, 440 feet high; and Lowis hill, 360 feet high, all of which have two summits; and Bluff point, 230 feet high, with an irregular summit.

CORAL BANKS.—West Coral, Middle and South banks are three great banks, composed of dead coral and sand, with some bunches of live coral, on the western side of the Andaman islands; the water over these banks is very clear, and, judging from the appearance of the bottom, it seems probable that the rollers break on Middle bank in the South-west monsoon, though they may not do so on the other banks.

West Coral bank, the northernmost, is 26 miles in length in a north-north-east and south-south-west direction, 3½ miles in breadth, and lies from 9 to 18 miles off the west coast of North Andaman, the shoalest part, with a depth of 6 fathoms, over rocky bottom, being distant 29 miles westward of Saddle North peak.

Middle bank, 10½ miles in length in a north and south direction, within the 25-fathoms contour line, 5½ miles in width, and oval shaped, lies about 16 miles westward of Middle Andaman island; the

Chart 825, Andaman islands. Var. 0° 20′ E.

least depth, 3¾ fathoms, where the rocky strata, which forms the ridge from which these banks rise, crops up for a few yards through the dead coral and sand, is situated 15 miles westward of Flat island.

South bank (*Lat. 12° 16′ N., Long. 92° 25′ E.*) is irregular in shape, about 9 miles in length, in a north and south direction, and 8 miles in greatest breadth, has a least depth of 6 fathoms near its centre, which is situated 16 miles westward of the west side of Spike island.

The 100-fathoms contour line passes close westward of the banks, and the increase of swell generally indicates their vicinity.

In the North-east monsoon they may be safely passed over, but a vessel of much draught must not cross the shoaler places. The navigation inside the banks to within 3 miles of the land is safe, except on the western side of North Andaman, to which a berth of 5 miles should be given.

Aspect.—From the centre of West Coral bank, Saddle hill is the highest visible land, and southward of it the hills fall rapidly, and only a few hummocks show above the horizon as far as White mountain, 1,184 feet high, which is isolated and situated 3½ miles westward of Kinserley point, on the south side of Stewart sound.

East coast hill may be seen a little farther southward in very clear weather, and, from a less distance, North Reef island and Interview island appear, the latter having a long level-topped ridge.

From Middle bank, Saddle hill is well above the horizon, but seldom visible. White mountain, bearing N.E. by E., appears whale backed, and a peak 703 feet high and situated 6 miles eastward of the southern end of Interview island just shows to the left of it. Southward of White mountain is East coast hill, a high range, with a sharp peak on the right slope of the highest part. West coast range of Middle Andaman island stretches from about E. by N. to E.S.E., and the land falls low at the southern extreme of the range in the vicinity of the Middle strait.

From South bank, White mountain is the northernmost land visible in clear weather; further southward is East coast peak, high, but very faint, with West coast peak and range close to the right of it; this range terminates at Spike island, the latter showing a small tuft at its northern end. Southward of Spike island the land continues low, with an occasional small peak until it rises to the high range eastward of Port Campbell.

Chart 3103, North part of North Andaman island.

COAST.—From Cape Thornhill to Bluff point, a distance of 4 miles, the coast trends south-westward, and is much indented.

General charts 830, 70.

Plan of Temple sound, 3190. Var. 0° 20′ E.

Bluff point (*Lat. 13° 28′ N., Long. 92° 53′ E.*), on the eastern side of the northern entrance to Temple sound, is 230 feet high, cliffy, bold in appearance, and from the southern entrance to Temple sound it shows three summits.

Charts 3103, 3190.

Reef island (Boa-pong), 1½ miles southward of Whitecliff island, is 7 cables long in a north and south direction, 4 cables broad, low, but covered with trees, the tops of which are 140 feet above the sea. A fringing reef surrounds the island except on its eastern side, and shoal water extends 9 cables south-westward of it. Irregular soundings of 5 to 9 fathoms extend 2$\frac{4}{10}$ miles west-south-west of the south-west extreme of the island.

Plan 3190, Temple sound.

TEMPLE SOUND, between Paget and Point islands, on the north-west, and Shearme island, on the east side, affords good anchorage, sheltered from all but south-westerly winds. The bottom in the sound is very uneven, and caution is necessary both in entering and anchoring, the plan being the best guide.

Paget island (Chopta-luk), 3¾ miles south-south-westward of Reef island, is 1¾ miles long in a north-east and south-west direction, 1¼ miles broad, 250 feet high to the top of the trees, but slightly elevated in places, and, owing to the way the trees have grown, it makes as a flat island; the south-east side is formed of cliffs 100 feet high.

Except on its eastern side it is surrounded by a fringing reef, which, with a shoal, extends for three-quarters of a mile northward of the north point.

Point island (Kora tharpit), southward of Paget island and separated from it by a channel nearly 2 cables broad, is one mile long in a north and south direction, 3 cables broad, and covered with trees, the tops of which are 150 feet high; it is almost entirely fringed by a reef on which are mangroves round the southern and eastern sides, the reef and shoal water within a depth of 5 fathoms extending 7 cables from the south-west side, and a detached reef and shoal 1¼ miles from the north-west point.

Sugar loaf islet, 3 cables off-shore, on the south-east side of the entrance to Temple sound, is a noticeable conical rock, 65 feet high.

Bolton shoal, lying nearly in mid channel of the entrance to the sound between the south point of Point island and Sugar loaf, has a least depth of 5 fathoms over it, is nearly circular, and a third of a mile in diameter within the 10-fathoms contour line.

General charts 825, 830, 70.

Plan 3190, Temple sound. Var. 0° 20′ E.

A shoal, with depths of from 5½ to 9 fathoms, extends 9 cables south-south-east from the south end of Point island, and nearly joins Bolton shoal.

Anchorage.—The anchorage, in from 10 to 12 fathoms water, over mud and sand, is in the centre of the head of the Sound about half a mile southward of Paget island.

Tides.—It is high water, full and change, in Temple sound at 9h. 10m.; springs rise 8 feet, neaps 5 feet.

Chart 825, Andaman islands.

COAST.—The west coast of North Andaman island, trending southward from abreast Paget and Point islands, for about 30 miles, to the western entrance of Austin strait, the narrow strait which separates North and Middle Andamans, is strewn with islands and reefs, for the position of which the chart is the best guide.

Mackey bank, 3¼ miles south-westward of the southern point of Point island, is about 2 square miles in extent, and has depths of 4 to 8 fathoms on it; vessels should pass outside this bank.

Hudson and Casuarina bays, situated 6 and 9 miles respectively, southward of Point island, are both shallow.

Shark islet (*Lat. 13° 12′ N., Long. 92° 44′ E.*), 3¾ miles off the coast, south-westward of Casuarina bay, is a small sandy islet half a cable in extent, covered with bushes 20 feet high, and surrounded for a distance of a cable by a coral reef, on which are some rocks above water. Vessels should pass outside the islet.

North Reef island (Tala murgu), nearly 3 miles in length in a north-north-west and opposite direction, and 1¾ miles in breadth, is a low flat wooded marshy island, 6½ miles southward of Shark islet; a reef projects nearly 2 miles off its south point. Austen islet, a small wooded sandstone islet, lies off the north-eastern point of North Reef island, with a channel between them; it is narrowed by a spit.

Anchorage.—There is a good anchorage in depths of from 6½ to 9 fathoms about 1¾ miles eastward of North Reef island; in approaching from the north-westward, round Austen islet at a distance of 4 cables, to clear a 3½ fathoms shoal lying 1½ miles northward of Austen islet, and also a spit extending about 3 cables southward of that islet.

Interview island (Tauteramiku) is 13 miles long in a north and south direction, and 3 miles broad, and its north point, which lies 4¼ miles southward of the south point of North Reef island, is low, rising gradually to 370 feet high, where it is level topped and wooded; the south point terminates in a cliff, close off which is a rocky pinnacle

22 feet high. Reefs and shoal water extend 2 miles off the north, and 3 miles off the south, points of the island.

Austin strait, which divides North and Middle Andaman islands, is entered eastward of the middle of Interview island (page 417).

South Reef islet, small and woody, lies one mile south-westward of the south point of Interview island, and a stony bank of 3 fathoms extends 2¾ miles south-eastward of the islet.

Port Andaman (*Lat. 12° 44′ N., Long. 92° 41′ E.*), the channel eastward of South Reef islet, has muddy water and very irregular soundings over rocky bottom at its entrance; this locality is dangerous, and the channel should be considered unnavigable until it has been surveyed.

Tuft island, about 6 miles south-south-eastward of the south point of Interview island, is a sand bank about 10 feet high. The large bay north-eastward of Tuft island is encumbered by reefs, and unfit for anchorage.

COAST.—The west coast of Middle Andaman island from abreast Tuft island trends southward for a distance of about 23 miles to the western entrance of Andaman strait, and appears bold and precipitous. Hump island lies about three-quarters of a mile off this coast at 3 miles southward of Tuft island, and Flat island about a mile off the coast at 9 miles southward of Tuft island. A 6-fathoms patch is situated at 4 miles south-westward of Hump island.

Plan of Port Anson on 3145.

ANDAMAN STRAIT.—Port Anson.—The south-west coast of Middle Andaman island, which forms the northern side of the northern entrance to Andaman strait and Port Anson, trends in a south-east direction for a distance of 2 miles; immediately south of the north-west part is Foul bay, filled with reef, and a reef extends 1½ cables off this coast in places to Brook point, within which is a rounded knoll 316 feet high.

Dangers.—A shoal, about half a mile in width, extends for a distance of 8½ cables, within the 10-fathoms contour line, from the west point of Foul bay, and has on it a rock with less than one fathom water over it, distant one cable, and Half tide rock, which dries 3 feet, distant half a mile from its south extreme; there are also rocks awash, and shoals with depths of from 2 to 3½ fathoms on different parts of it.

Spike island (Tao boroga), the northern side of which, between Breaker and Steep points, one mile apart, forms the south side of the entrance to the strait and port, is 4 miles in length, in the form of an isosceles triangle, with its apex to the southward; the southern entrance to the strait and port is southward of this island, but, although deep, it is dangerous.

Spike island is 448 feet high at its northern, and 309 feet at its southern, end, and is densely covered with jungle. The northern side has a narrow fringing reef and shoal water extending off it for nearly 2 cables, and on the western side the island has a fringing reef extending 1¾ cables in places; shoal water stretches 3 cables north-west of Breaker point and 3½ cables from the west side of the island, at about a mile southward of that point. Rocks from one foot to 6 feet high stand on the edge of the reef fringing the western side, and of these Long rock and Cinque rocks are about midway of the length of the island.

Braganza ledge (*Lat. 12° 18′ N., Long. 92° 42′ E.*), on the south side of the entrance, has a depth of 4½ fathoms over it, and is situated nearly half a mile north-westward of Breaker point.

Taylor patches, about one mile in length, in a north and south direction, within the 10-fathoms contour line, have a least depth of 4¾ fathoms, which is situated 1½ miles south-west of Breaker point.

Entrance:—Depths.—The northern entrance, which is 1¾ miles in width between the west point of Foul bay and Breaker point, is narrowed to about half a mile by the shoal southward of Half tide rock and Braganza ledge, and retaining that width for about three-quarters of a mile, then narrows to 1¾ cables, between the fringing reefs and shoals off Brook and Steep points; the depths in the outer part of the entrance are from 13 to 17 fathoms, increasing to from 22 to 40 fathoms further in. The depths in Port Anson are from 9 to 11 fathoms.

Port Anson is about 2¼ miles in length in a north and south direction, and two-thirds of a mile in width, and the eastern side of Spike island, which forms its western side, is comparatively steep-to in places, but has some islets and reefs which dry off it; Stoat, Mangrove, and Tala Kaicha islands, forming the eastern side of the port, have fringing reefs, and a detached reef lies half a mile westward of the northern end of the latter island.

In the southern part of the port, Whales and other reefs extend for 6 cables in a north and south direction, and 2 cables westward of the southern end of Tala Kaicha island is a reef which dries at high water, spring tides.

Stoat island, about 7 cables long in a north and south direction, 1¼ cables wide, and 140 feet high, has a very narrow fringing reef on its western side, which extends a cable off the north and south points; its north point is 8 cables eastward of Steep point. The entrance to Homfray strait is northward of Stoat island.

Mangrove island (*Lat. 12° 16' N., Long. 92° 43' E.*), 3½ cables southward of Stoat island, is about half a mile long in a north-north-east and opposite direction, and has a reef extending nearly 2 cables off its western side.

Tala Kaicha island, 2¾ miles in length and overlapping the two preceding islands to the eastward, is about 4 cables wide and 330 feet high.

Whales reef, nearly circular, and 1¾ cables in diameter, dries in patches at low water, spring tides, and lies 7 cables north-westward of the south point of Tala Kaicha island; it and the two reefs lying about 2 and 4 cables, respectively, to the southward of it are generally, but not always, visible.

Directions.—Port Anson.—From the westward, approach with the low mangrove north point of Stoat island just open of Brook point, bearing S. 68° E., and when about a quarter of a mile from that point, keep in mid-channel, and, rounding Steep point, the north-eastern point of Spike island, steer to the southward and anchor in depths of from 9 to 10 fathoms, over muddy bottom.

Through Andaman strait.—If proceeding through Andaman strait, steer to the southward in mid-channel in Port Anson until abreast the south end of Mangrove island, when edge eastward until the apex of a fine conical peak to the northward opens just in sight eastward of the nearer hills which form the western side of a large mangrove valley bearing N. 3° E.,* when steer S. 3° W., using it as a stern mark, which leads between the ledge of rocks that is dry at high water, spring tides, 2 cables north-westward of the south end of Tala Kaicha island, and Whales reef and the reefs southward of it.

When the south extreme of Tala kaicha island bears East, steer about S.W. ½ S. for the south point of Spike island, giving the north-western side of a narrow promontory, on the port hand, a berth of about 3 cables, and avoiding the reefs off the southern part of Spike island, and steer southward on the western side of the sound.

When the island with two small hillocks on it, at the western end of the narrows, bears about E.S.E., steer to pass southward of it, and continue in mid-channel through the straits.

At spring tides do not attempt to pass through the narrows during the strength of the tidal stream, which is slack at the times of high and low water at Port Blair; at neaps the streams are scarcely felt. *See* also page 402.

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* This leading mark is not shown on the plan nor on the chart.

Plan of Port Anson on 3145. Var. 0° 20′ E.

Tides.—It is high water, full and change, at the south point of Spike island, at 9h. 25m.; springs rise 7 feet, neaps 5 feet.

Chart 1419, Long island to Port Blair.

HOMFRAY STRAIT (Chara Juru), between Middle Andaman and Baratang islands, is about 11 miles in length, intricate, and rocky, but the depths in the fairway are not less than 2¾ fathoms until nearing the eastern entrance, where there is a broad bar on which there is apparently a depth of 1½ fathoms, over sand and gravel. The narrowest part of this strait is about 60 yards in width, and the bamboo grows plentifully on its banks. The tidal streams are strong with many eddies. *See* page 415.

Plan 3145.

WEST COAST.—Cape Bluff (*Lat. 12° 14′ N., Long. 92° 41′ E.*), the northern point of South Andaman island, is 287 feet high, cliffy, with a reef a short distance round it; Bluff island, 4 cables in length in a north-north-west and opposite direction, 2 cables in breadth, and wooded, the tops of the trees being about 100 feet high, lies a quarter of a mile northward of the cape.

A reef extends 3 cables westward and 5 cables northward of Bluff island, leaving a very narrow channel with a least depth of 1½ fathoms between the cape and the island, and a deep but narrow and intricate passage between the cape and island and Spike island.

Chart 825, Andaman islands.

From Cape Bluff the west coast of South Andaman island trends southward for about 17 miles to Petrie islet, on the northern side of the entrance to Port Campbell; there are no known off-lying rocks or shoals on this coast.

Plan of Port Campbell on 898.

PORT CAMPBELL, nearly 2½ miles in length in a north and south direction, from half a mile to 1¼ miles in width, is a fine harbour, with anchorage in depths of from 6 to 12 fathoms, over a bottom of ooze; the shelter within is perfect, as the port is almost landlocked, but, owing to the narrow entrance, it is not easy of access to sailing vessels. In the vicinity of the port the cliffs are of yellowish grey sandstone, in which the strata lines show very plainly.

Petrie islet, on the northern side of the entrance, is connected by shallow water with the north-west point of an island about 3 miles in length in a north-north-west and opposite direction, which partly forms the eastern side of the port.

Montgomery islet, on the southern side of the entrance, is connected to the entrance point on that side by rocks, and from it the western side of the port has a general south-south-east direction to its head.

Plan of Port Campbell on 898. Var. 0° 20′ E.

Dangers.—A shoal extends for half a mile in a southerly direction from Petrie islet, and another from the middle of the western side of the island, to which Petrie island is connected; the latter extends in a south-westerly direction for more than a mile into the port, has a breadth of about half a mile, and on it are some rocks awash.

A shoal stretches in a north-east direction from the west side of the port, nearly a mile southward of Montgomery islet, for a distance of a mile, and has from 2 to 3 fathoms water near its extreme.

Entrance.—Depths.—The entrance to the port between Petrie and Montgomery islets is about 1¾ miles in width, but is narrowed to 8 cables between the extremes of the shoals above mentioned, and within is further reduced to a quarter of a mile between their edges.

A shallow patch with from 5 to 6½ fathoms lies in the entrance, but otherwise the depths are from 9 to 16 fathoms, with from 9 to 12 fathoms at the anchorages.

Anchorages.—There is anchorage in about 12 fathoms water at the entrance, about 8 cables north-eastward of Montgomery island, and, in a similar depth, in the centre of the port about 1$\frac{1}{10}$ miles south-east of the same island; several other anchorages are charted.

Village (*Lat. 11° 57′ N., Long. 92° 34′ E.*).—A native village is situated on the main island near Montgomery islet; water and wood are abundant.

Tides.—It is high water, full and change, in Port Campbell, at 8h. 26m.; springs rise 6 feet.

Chart 825, Andaman islands.

WEST COAST.—From Montgomery islet the west coast of South Andaman island continues south-south-westward and southward for 15 miles to Palmer point; it is very little known, and appears to have several salient points fringed with coral reefs.

Chart 1398, Port Blair to Little Andaman island.

Constance bay, eastward of Palmer point, is shoal, with several islets and reefs in it. A large rock above water lies on the southern edge of the reef at about a mile southward of Palmer point, and a rocky bank with 3¼ to 8 fathoms over it extends 1¼ miles westward and 2 miles south-south-westward of the rock.

Tarmugli island, the north-western island of the Labyrinth group, lies with Frederick point, its northern end, situated 5½ miles south-south-westward of Palmer point, whence it extends southward 3 miles, with a breadth of about 2 miles; it is 257 feet in height, and its south-western point is cliffy, with two rocks, 15 feet high, close off it.

Chart 1398, Port Blair to Little Andaman island. Var. 0° 20′ E.

A continuous reef fringes its northern side with a large area of foul ground extending 2½ miles northward and enclosing Allen patches, a part of which is awash at low water, spring tides; it is separated from the shoal water off Palmer point by a channel of clear water about 7 cables wide.

An irregular reef, with off-lying patches, borders the western side of the island for a distance of 1¼ miles.

Currents.—On the western side of the Labyrinth islands in the fine season the surface current runs southward, but it occasionally reverses for periods of about 24 hours.

Plan of Port Mouat on 898.

PORT MOUAT (*Lat. 18° 38′ N., Long. 92° 37′ E.*), north-eastward of Tarmuglī island, and nearly abreast Port Blair on the eastern coast, extends eastward for about 1¼ miles from the entrance between Perseus and Andromeda points to the narrow entrance to a nearly circular basin, about half a mile in diameter.

About a mile eastward of the entrance, the harbour contracts to a width of 1½ cables, and the navigable channel to little more than half a cable.

Perseus point, on the north side of the entrance, consists of low wooded hills, the tops of the trees being about 100 feet high, and from it the southern edge of a reef, on which are rocks awash and drying, extend 1¼ miles in a west-south-west direction to the 10-fathoms contour line, which, near its extreme, encloses Hooper patch, with from 2 to 2½ fathoms water over it.

A flat, with rocks and a sandy spit on it, extends for a distance of 3 cables southward of Perseus point and the land for 4 cables eastward of it. A shoal, with rocks at its extreme, on which there is a depth of less than one fathom, extends three-quarters of a mile westward of Andromeda point on the south side of the entrance, and northward of the point a somewhat similar flat to that on the northern side borders the shore extending half a mile.

Two patches with a depth of 2¼ fathoms over them lie in the centre of the channel between the edges of these flats.

Entrance. — Depths. — The entrance, between the flats extending from each entrance point, is about 3 cables in width, but the 2¼-fathoms patches in the centre narrow it to one cable either northward or southward of them; inside these the general breadth is about 3 cables for three-quarters of a mile, when shoals from each inner entrance point contract the channel to one cable, and between these points it has only a width of half a cable.

Plan of Port Mouat on 898. Var. 0° 20′ E.

The depths are from 7 to 10 fathoms either north or south of the 2½-fathoms patches, decreasing to 7 fathoms till in the inner entrance, when they are from 11 to 20 fathoms, shoaling to 5½ and 4½ fathoms in the basin.

Directions.—With the western side of Tarmugli island bearing eastward of South, bring Perseus point to bear E. by S., and steer for it on that bearing, which leads between the shoal ground southward of Palmer point and the northern end of Allen patches, and when Grub island, 144 feet high, small, and with a high yellow cliff, is in line with Fords peak, Rutland island, bearing S. 21° E., steer with this mark on, which leads between Allen and Hooper patches.

The northern inner entrance point of Port Mouat bearing E. ⅜ N. leads between the northern edge of the flat extending northward of Andrómeda point and the 2½-fathoms patches in mid-channel, but the plan of Port Mouat should be used with caution until the locality has been re-surveyed, and before entering it would be advisable to buoy the 2½-fathoms patches.

Tides.—It is high water, full and change, at Port Mouat at 8h. 40m.; springs rise 5 feet.

Chart 3103, North part of North Andaman island. Var. 0° 30′ E.

COCO CHANNEL (*Lat. 13° 47′ N., Long. 93° 10′ E.*), between Landfall island, the northern of the Andaman islands, and Little Coco island, is 21 miles broad, contracted to about 17 miles by Daphne rock and South patch; southward of these dangers, for a distance of about 6 miles, the depths are from 20 to 52 fathoms, but between that and Landfall island they are from 8 to 25 fathoms, the bottom being coral, with occasional sand and mud patches, and somewhat irregular in the southern portion. A patch of 10 fathoms is situated about 9 miles north-eastward of East island, and the strong tidal streams cause a heavy sea over this shoal in bad weather.

Currents.—During the North-east monsoon the current frequently sets north-westward through Coco channel; but in the South-west monsoon its direction is mostly to the eastward.

Tidal streams.—In Coco channel during settled weather there are regular tidal streams, the flood setting eastward, and the ebb westward, at rates of from one knot to 2 knots at springs. The streams are much influenced, and frequently even reversed, by strong winds.

Tide rips occur in the vicinity of all shoal water in the Coco channel.

Caution.—The northern end of the Andaman islands should not be approached nearer than 4 miles, nor the southern end of Little Coco island nearer than 5 miles.

COCO GROUP consists of three islands, Little Coco, Great Coco, and Table islands; the southern point of Little Coco, the southern of the group, lies 21½ miles north-north-eastward of the eastern point of Landfall island. They are included in the Hanthawaddy district of Burma.

Little Coco island (*Lat. 14° 0′ N., Long. 93° 13′ E.*), 2$\frac{6}{10}$ miles in length in a north and south direction, and three-quarters of a mile in greatest width, is densely wooded, and 247 feet high in its centre; it is surrounded by a belt of cocoanut trees, and there is a lagoon at its southern end, but the water is not drinkable. There are a few wild pigs on the island.

The island is surrounded by a coral reef, which extends only a short distance from its eastern and western sides, but half a mile around the north end of the island with irregular soundings for more than a mile northward of its edge, and the same distance from the south-west point, and foul and uneven ground continues for 4 miles southward of the island.

Anchorage.—During easterly winds, there is good anchorage in depths of from 9 to 12 fathoms, over sand and mud, with smooth water, in Lambert bay on the western side of the island. The water there shoals gradually; on the eastern side of the island the bottom is rocky and foul.

South patch, of coral, on which 7 fathoms was the least depth found, but on which there may be less water, lies 3¾ miles southward of the south point of Little Coco island; vessels should pass southward of this patch.

Daphne rock, a small coral patch, with a depth of 2¾ fathoms over it, lies 2½ miles southward of the south point of Little Coco.

Middle rock, with less than one fathom water over it, lies 2 miles southward of the same point, between which and Middle rock the ground is uneven, with rocky patches awash situated 6 cables southward of the island.

Investigator patch, on which there is a least depth of 1½ fathoms, is an area of shoal and rocky ground, nearly circular, and about 1½ miles in diameter, lying 2 miles east-south-eastward from the south point of Little Coco.

Alexandra channel, separating Little Coco and Great Coco islands, is 7¼ miles in width between the 10-fathoms contour lines on either side, and has depths of less than 20 fathoms on the western

Chart 3103, North part of North Andaman island. Var. 0° 30′ E.

side for a distance of 3 miles from Little Coco island, but on the eastern side the depths are from 31 to 37 fathoms.

GREAT COCO ISLAND, 5¾ miles in length in a north and south direction, and 1$\frac{1}{10}$ miles greatest breadth, lies 8¼ miles north-eastward of Little Coco island; it rises very steeply, with a few bare patches on its western side, and slopes gradually eastward, where it is densely wooded; it is 366 feet high near both extremes.

A reef projects one mile southward of the south point, with Jerry islet, 97 feet high and wooded, near its extremity, from which rocky and uneven ground stretches to the southward for nearly 2 miles, the southern side of which should not be approached within a mile.

There are no outlying dangers, but rocky and foul ground extends 4 cables from its north-western and 2 cables from its northern points.

Plan of Table island and Marshall island on 825. Var. 0° 30′ E.

Pechee point, on the eastern side of Great Coco island, one mile south-eastward from its north point, is a bluff 150 feet high, surmounted by a few trees, and connected with the mainland by a low neck. Binnacle rock, about 14 feet high, is situated on the extreme of a reef which extends 3 cables north-eastward in Pollok bay; it is 4 cables west-north-west of Pechee point.

Rat islet, about one mile southward of Pechee point, is 125 feet high, small and wooded, with reefs extending 2 cables eastward, and others connecting it with the mainland.

Ford bay, between Pechee point and Rat islet, affords good sheltered anchorage with strong westerly winds, in depths of from 7 to 10 fathoms, over sand and mud, with Rat islet bearing S. ¼ W., distant about 6 cables.

Supplies.—There are a number of wild cattle on Great Coco, but it is difficult to shoot them, as the jungle is almost impenetrable. A belt of cocoanut trees surrounds the island, and there is a small fresh water lagoon on the low neck connecting Pechee point with the island.

Marshall channel, separating Great Coco island from Table and Slipper islands to the northward, is 6½ cables in width between the 5-fathoms contour lines of those islands, and has depths of from 5½ to 9 fathoms.

Table island (*Lat. 14° 11′ N., Long. 93° 23′ E.*), about 8 cables long in a north and south direction, 6 cables wide, 146 feet high, and densely wooded, except on its south-western side, presents a flat level surface with steep sides on all bearings.

Slipper island, 2 cables north-westward of Table island, and connected to it by a reef that dries, is about 2½ cables long in an east

Plan of Table island and Marshall channel on 825. Var. 0° 30′ E.

and west direction, one cable wide, 113 feet high; it is covered with grass, with a few trees near the summit. A remarkable pillar rock is situated near its western extreme.

The surrounding reef projects three-quarters of a mile north-westward from Slipper island, half a mile north-eastward from the north point of Table island, and 3½ cables southward from the south point of that island. A 6½-fathoms patch lies 1$\frac{3}{10}$ miles north-eastward of Table island, and irregular soundings, causing tide ripples and swirls, extend 4½ miles east-north-eastward of the island.

CAUTION.—Besides the irregular soundings, the tidal streams in this locality are strong, and often set on the rocks; vessels should therefore keep well to the northward of Table island.

A gun is kept on Table island for the purpose of warning vessels when appearing to pass too close to the reefs off the island.

LIGHT (*Lat. 14° 11′ N., Long. 93° 21′ E.*).—A cylindrical tower, 91 feet in height, and painted red and white in alternate bands, on a grassy ridge at the south-western and highest part of Table island, exhibits, at an elevation of 195 feet above high water, a *white group-flashing* light, with a period of system of *ten seconds*, showing *two* flashes, which should be visible, in clear weather, from a distance of 20 miles. (*View on 825.*)

Anchorages.—Anchorage, in the North-east monsoon, may be obtained in a depth of 10 fathoms, over rock, in Table bay on the south-west side of the island, with the lighthouse bearing N. by E., at about 3 cables off-shore; but care should be exercised when anchoring so as not to be too close to the reef, nor so far out as to be in the strength of the tidal stream.

During the South-west monsoon the anchorage is in from 9 to 12 fathoms water, over sand and rock, on the northern side of the island, with the lighthouse bearing South, at about 4 cables off-shore, but this position is exposed.

Landing.—The landing place, on the south-west side of the island, on the rocks immediately under the lighthouse, is not convenient, but is better at high than low water.

On the north side of the island the landing place, marked by stakes on the reef, is bad and dangerous, except in fine weather; the state of the landing, whether landing is dangerous or not, is indicated to a vessel anchoring by the light-keeper.

Supplies.—There are a number of wild cattle on Table island, but they are not easily shot; a few cocoanuts can be obtained, but the supply of vegetables and water is only sufficient for the light-keeper's use.

General charts 825, 830, 70.

Plan of Table island and Marshall channel on 825. Var. 0° 30′ E.

Tides.—It is high water, full and change, at Table island, at 9h. 53m.; springs rise 8¼ feet, neaps 5¾ feet, and neaps range 2¾ feet.

Tidal streams.—The flood stream runs eastward, the ebb westward; and in settled weather the streams appear to turn at high and low water. The rate of the tidal streams is upwards of 5 knots in Marshall channel, and about 2 knots past the north and south ends of Little Coco.

Even in fine weather there are heavy tide races off all the salient points, especially at both ends of Little Coco, in Marshall channel, off the north-western point of Slipper island, north-eastward of Table island and southward of Jerry islet.

General charts 825, 830, 70.

CHAPTER IX.

PREPARIS CHANNELS, AND GULF OF MARTABAN TO TAVOY RIVER.

(*Lat.* 15° 57′ *N. to Lat.* 13° 35′ *N.*)
(*Long.* 93° 20′ *E. to Long.* 98° 13′ *E.*)
VARIATION: Decreasing about 2 minutes annually.

Chart 825, Andaman islands.

PREPARIS SOUTH CHANNEL, separating Table island of the Coco group from Preparis island, is about 35 miles in width, and there are depths of 109 and 150 fathoms, coarse sand, near its central part. This channel is often used by vessels working down the Bay of Bengal against the South-west monsoon from Calcutta to pass eastward or to leeward of the Andaman islands. Table island, with its light, affords a good mark.

Chart 823, Koronge island to White point. Var. 0° 50′ E.

Preparis island (*Lat.* 14° 53′ *N., Long.* 93° 40′ *E.*), situated nearly midway between Great Andaman island and the coast of Pegu and 55 miles south-south-west of Alguada lighthouse, is 4½ miles in length in a north-north-east and south-south-west direction, about three-quarters of a mile in breadth, and 265 feet in height, covered with wood, and slopes gradually.

A reef fringes the island and extends southward in a spit about half a mile wide for a distance of 3½ miles from its southern point.

The eastern side of the island is steep, there being a depth of 10 fathoms about three-quarters of a mile from the shore. The island was uninhabited in 1887, when many monkeys were seen there, and a few turtles.

Dangers.—A pinnacle rock, 40 feet high, lies 4½ miles south-westward of the south point of Preparis island, and a reef extends 2½ miles southward from this rock, having, near its southern end, a small rock 6 feet high; this reef is surrounded by a bank with depths of from 4 to 10 fathoms, its southern end being 7 miles south-south-west of the south point of Preparis island.

General charts 825, 830, 70.

Chart 823, Koronge island to White point. Var. 0° 50′ E.

A reef 2½ miles in length in a north and south direction, and 1½ miles wide, with some islets, about 90 feet high, upon it, lies with its outer edge 2½ miles westward of Preparis island; in the narrow channel between this reef and the island, the depths are from 9 to 15 fathoms.

A rock, awash at low water, lies about a quarter of a mile off-shore and about three-quarters of a mile south-south-east of the north-eastern point of Preparis island.

Cow and Calf islets (*Lat. 14° 56′ N., Long. 93° 41′ E.*), three in number, cliffy, flat-topped, and 77 feet high, lie close together about 1¼ miles north-north-eastward of the northern end of Preparis island; a bank with depths of from 6 to 10 fathoms over it extends nearly 2 miles south-eastward from them, and a pinnacle rock with about 1½ fathoms water over it is reported to have been seen at the south-eastern end of this bank, about 2 miles eastward of the north-end of Preparis island.

A narrow channel, in which are depths of 11 to 24 fathoms, separates these islets from Preparis island.

Anchorage.—During the South-west monsoon there is anchorage on the eastern side of Preparis island in depths of from 12 to 14 fathoms; and during the North-east monsoon anchorage can be found on the western side.

Water.—On the eastern side of Preparis island, south-east of its highest part, and at a few paces from a sandy beach, formed between two ledges of rock, where boats can land with safety, there is a pond of fresh water, convenient for watering.

PREPARIS NORTH CHANNEL, between Preparis island and Alguada reefs, is about 52 miles in width, with general depths of from 15 to 50 fathoms.

Thalia shoal, on which the least depth found is 10 fathoms, over coral bottom, is about 1½ miles in length, in a north-north-west and south-south-east direction, and three-quarters of a mile in width within the 20-fathoms contour line; it is situated 20 miles northward of Cow and Calf islets. The depths around the shoal vary from 24 to 46 fathoms, the bottom generally being grey sand and coral.

Tide rips are charted about 19 miles westward of Alguada lighthouse in a position where breakers were reported in 1907.

The 100-fathoms contour line appears to run almost North, with slight indentations, from Preparis island to a position about 25 miles westward of Cape Negrais.

General charts 830, 70.

Plan 834, Bassein river and approaches. Var. 0° 50′ E.

ALGUADA REEFS, on the northern side of Preparis North channel, and about 1⅝ miles in length in a north-east and south-west direction, are nearly awash at high water, spring tides.

There are detached sunken rocks at a considerable distance from Alguada reefs, the shoalest to the southward being a patch, with 2¼ fathoms water over it, about 1¼ miles southward of the lighthouse; and amongst the several patches northward of the reefs, Hugh Rose rock, awash at low water, and 2½ miles north-north-east of the lighthouse, is the northernmost and shoalest.

LIGHT (*Lat. 15° 42′ N., Long. 94° 12′ E.*).—A granite tower, 160 feet in height, painted in black and white bands, 18 feet wide, with black base, situated on the south-western part of Alguada reefs, exhibits, at an elevation of 144 feet above high water, a *white flashing* light, with a period of system of *ten seconds*, showing a flash for *one second*, followed by an eclipse of *nine seconds* duration; it should be visible from a distance of 18 miles in clear weather. (*Views on 834, 823.*)

Directions.—The lighthouse should not be approached on northerly bearings nearer than 3 miles, at which distance its angle of elevation from vane to base is 30′. Haing-gyi island summit well open eastward of Diamond island, bearing N. 19° E., leads about half a mile eastward of the shoal water off Alguada reefs, and of Phaeton shoals.

Tides.—It is high water, full and change, at Alguada lighthouse at 9h. 13m.; springs rise 8½ feet, neaps rise 6 feet.

Tidal streams.—In Preparis North channel the tidal streams during the North-east monsoon are very irregular; at springs the flood stream sets south-south-eastward and south-eastward, and the ebb south-westward at a rate of about 2 knots; during neaps there is usually a constant set southward, of from one knot to 1½ knots an hour, but the ebb stream has been found setting northward at about half to three-quarters of a knot for 6 hours.

At Alguada reefs the streams are much influenced by the winds, especially at neaps; the flood stream usually sets south-eastward, and the ebb north-westward. In the North-east monsoon at springs the ebb stream begins about 2 hours after high water and runs until low water, at a rate of from one knot to 2 knots an hour, the period of slack water being very short.

Chart 823, Koronge island to White point.

IRRAWADDY RIVER, formed by the junction of the N'maikha and Malikha, two streams which rise in the hills in the north extreme of the Province, reaches the sea by nine principal mouths, viz., Bassein (and its eastern entrance the Thatkethaung),

Chart 823, Koronge island to White point. Var. 0° 50′ E.

Ywe, Pyamalaw, Irrawaddy (Yahaudi), Kyondon (Da-la), Pyapon, China Bakír, or Thou khwa, and Rangoon. Some of these are of considerable breadth, but the Bassein and Rangoon mouths are the only ones at present used by seagoing ships. The Irrawaddy mouth, in long. 95° 3′ E., is said to be the straightest channel to the sea; it has a depth on the bar of 12 feet at low water springs, but is seldom used.

It is navigable through the greater part of its course for steam vessels at one season of the year, and the steamers of the Irrawaddy Flotilla Company run through the greater part of its course, bringing exports from the up-country stations, and returning with imports; some of these vessels are in themselves floating bazaars.

The river is the main source of water supply to the towns and villages on its banks, but it is tidal as far as Danubyu, about 70 miles from the coast; at two points, between Amarapura and Sagaing and between Tharrawaw and Henzada, it cuts through a line of railway and is crossed by a steam ferry, and is at present bridged in no part, but a railway bridge is contemplated at the former of the two ferries.

The Irrawaddy delta is constantly encroaching on the sea, owing to the immense quantity of silt brought down by the river, and is cut up into many low islands by numerous tidal creeks and channels. Scattered along the southern parts of these are temporary villages, occupied during the dry season by salt boilers and makers of *nga pi* or fish paste.

(For inner navigation of Irrawaddy river, *see* page 469.)

Plan 834, Bassein river and approaches.

BASSEIN RIVER (*Lat. 15° 55′ N., Long. 94° 17′ E.*) leaves the main channel a few miles above Henzada town, and flows in a south-westerly direction past Lemyethna and Ngathainggyaung-Daunggyi towns, through flat delta country, to Bassein; it is the western of the channels by which the Irrawaddy reaches the sea, is connected with the other mouths by numerous large tidal creeks, and is navigable for a considerable distance. Its banks are for the most part low and covered with thick jungle.

The river is about 12 miles wide at the entrance between Pagoda Mawdeng and Purian points, but its breadth soon decreases to 2½ miles at the northern end of Haing-gyi island, and it is only 2 cables wide off the town of Bassein. (*Views A and B on 834.*)

Bar.—Depths.—The bar is formed by an irregular-shaped shoal with depths under 5 fathoms, which stretches across the entrance to the river, to the northward of Diamond island, between a shoal flat eastward of Pagoda or Mawdeng point and the western extreme of Purian bank, the distance between these shoals being about 3¼ miles;

Plan 834, Bassein river and approaches. Var. 0° 50′ E.
Orestes shoal, about 6 cables in extent, with a depth of 3 fathoms over it, faces the middle of the bar.

The least depth on the bar, near the leading mark, is 3½ fathoms, but somewhat less water has been reported; inside the bar the depths increase to 6 and 10 fathoms, as far as Haing-gyi island, and then decrease, and abreast Amazon point, about 35 miles above Haing-gyi island, is a bar with a charted depth of 3¼ fathoms, but the depths are subject to change, and a vessel of 26-feet draught has reached Bassein town.

The channel within the bar in some places constantly changes, which, as well as the numerous shoals and rocks, makes its navigation difficult and renders the employment of a pilot necessary.

Pilots can be obtained at Diamond island.

Phaeton shoals, several rocky patches with 2¼ to 3 fathoms water over them, lying midway between Alguada reefs and Diamond island, extend about $2\frac{6}{10}$ miles in length in a north-north-east and south-south-west direction, and are 1½ miles in greatest width within the 5-fathoms contour line.

Caution.—The passage between Alguada reefs and Diamond island should not be attempted, as the locality is dangerous.

Diamond island (*Lat. 15° 52′ N., Long. 94° 16′ E.*), fronting the entrance to Bassein river, is flat, wooded, and 116 feet high, with a flagstaff, 144 feet high, a telegraph house with arched verandah on its eastern side, and the pilot's bungalow, the only house seen on northerly bearings, on the hillock southward of the flagstaff.

The island is surrounded by reefs and shoal water to a greatest distance of about 4 cables from its southern end, from which also reefs, some awash at high water, and foul ground extend $2\frac{4}{10}$ miles south-south-westward; there are patches of 4½ cables nearly a mile distant from the western side of the island.

Turtles frequent the island at all times, but, being a government monopoly, they must not be taken or disturbed.

LIGHT.—A *white fixed* light is exhibited at an elevation of 115 feet above high water from the flagstaff, painted white, on Diamond island, and should be visible, in clear weather, from a distance of 9 miles.

Signal station. — Wireless telegraph. — The signal station, belonging to the Indian telegraph department, can signal messages or orders by means of the International code, and has telegraphic communication with Bassein.

Storm signals are shown from the flagstaff on Diamond island. *See* pages 74-76.

General charts 152, 823, 830, 70.

Plan 834, Bassein river and approaches. Var. 0° 50′ E.

Landing.—In the North-east monsoon landing may be effected in the little bay on the eastern side of the island, but in the South-west monsoon it is often impracticable.

Baroni rock, with 2¾ fathoms water over it, lies half a mile north-eastward of the north end of Diamond island, and depths of 3½ to 3¾ fathoms stretch a quarter of a mile northward of the rock.

Buoy.—A spherical buoy, painted black with a white horizontal band, is moored 3 cables north-north-east of Baroni rock, on the edge of the 5-fathoms contour line.

Clearing mark.—Alguada lighthouse well open eastward of Diamond island, bearing S. 26° W., leads eastward of Baroni rock; and Pagoda point, bearing N.N.W. ⅝ W., with Cape Negrais just shut in, leads close north-eastward of the rock, but over a depth of 3¼ fathoms.

Outer anchorage.—There is good anchorage in the North-east monsoon, in depths of from 4½ to 5 fathoms, about three-quarters of a mile eastward of Diamond island, with Diamond island flagstaff bearing about W.N.W., and Haing-gyi summit N. by E. ½ E.

Prohibited anchorages.—To protect the telegraph cable laid from Diamond island to Pagoda point, anchorage is prohibited with the north-eastern point of Diamond island bearing between S.S.E. ⅝ E. and S. ½ E., or within 1½ miles from the northern point of that island.

Anchorage is also not permitted between the telegraph houses, which are painted white, and situated one on each side of the river, in Ngaputau reach, about 15 miles below Bassein.

Pagoda (Mawdeng) point (*Lat. 15°57′ N., Long. 94°14′ E.*), the western entrance point of the river, and about 5¼ miles north-north-west of Diamond island, is flat, about 100 feet high, and terminates in a bluff with rather bare sides, the south-western being steepest. The great pagoda, on the extremity of the point, is 144 feet high, and shows above the trees near it.

A reef, the outer part of which covers at half tide, extends a quarter of a mile off Pagoda point, and there are depths under 3 fathoms for about 6 cables southward of the point.

Obelisk.—A small obelisk, 9 feet high, is situated on the reef, near the south-eastern extreme of the point.

Landing.—Water.—Eastward of the obelisk there is shelter for boats and landing in the North-east monsoon; and good fresh water may be obtained from the well at the bottom of the steps leading to the pagoda.

General charts 152, 823, 830, 70.

Plan 834, Bassein river and approaches. Var. 0° 50′ E.

Haing-gyi island, 3½ miles north-eastward of Pagoda point, and on the western side of the river, is triangular in shape, about 3¾ miles in length in a north-east and south-west direction, and 2½ miles in width at its southern side; a hill, 8 cables from North-east point of the island, is 445 feet high, densely wooded, sloping away to the southward, and conspicuous; the rest of the island is flat and covered with jungle about 35 feet high, but a large round tree, 72 feet high, on the South-east point of the island is useful as a mark.

Sand cay, a rocky patch, part of which is 2 feet above high water, lies about 5 cables south-westward of Rocky point, the south extreme of the island, and shoal water, with depths of less than 3 fathoms, fills the bight between Sand cay and Pagoda point, and midway between them extends 1¼ miles southward of the line joining the cay and point.

The channel westward of Haing-gyi is navigable only by boats at high water.

Village.—A village is situated at the northern end of the island, and the inhabitants are chiefly employed in fishing and manufacturing fish paste.

Water.—Good water can be obtained at the village.

Wolf rock, 4 cables from the eastern side of Haing-gyi, dries at low water, and shoal water extends about the same distance eastward of the rock.

Buoy.—A can buoy, painted black, is moored on the edge of the 5-fathoms contour line, eastward of the rock.

Purian point (*Lat. 15° 50′ N., Long. 94° 23′ E.*), on the eastern side of Bassein river entrance, and about 7 miles east-south-east of Diamond island, is low like all the eastern shore of the river, but near its extremity a grove of trees, 75 feet high, shows above the ground northward. White sandstone cliffs about 10 feet high extend 1½ miles north-eastward of the point.

A patch of reef, which dries 6 feet, lies about 8 cables south-south-west of Purian point, and rocks stretch off the south-western sides of the point.

Martin rocks, a small patch 4 feet high, dark and jagged in appearance, lie about 9 cables north-westward of Purian point; and on the western side of the point, abreast these rocks, white sandstone cliffs, 30 to 45 feet high, extend for 1¼ miles, and are then lost in the jungle.

Purian bank.—Ward point lies about 10¾ miles northward of Purian point, and Purian bank, on which are depths of less than 3 fathoms, extends about 5½ miles westward of the shore between them.

General charts 152, 823, 830, 70.

Plan 834, Bassein river and approaches. Var. 0° 50′ E.

Orestes shoal, lying between Pagoda point and Diamond island, has depths of 3 fathoms, and is about 6 cables in extent.

Buoys.—A nun buoy, painted black, is moored about 1¼ miles north-eastward of Orestes shoal.*

A conical buoy, painted red, is moored in about 6 fathoms water 2 2/10 miles southward of the South-east point of Haing-gyi island.

Burgess rock (*Lat. 16° 0′ N., Long. 94° 21′ E.*).—Burgess rock, with a depth of 3 fathoms over it, lies on the eastern side of mid-channel, at about one mile south-eastward of the North-east point of Haing-gyi island; the shoal surrounding it is about 2 cables in extent inside the 5-fathoms contour lines.

Buoy.—A nun buoy, painted red, is moored on the northern side of Burgess rock. The buoy should be passed on its western side and given a berth of not less than 2 cables.

Directions.—It is usual in approaching Bassein river to pass westward of Diamond island, giving it a berth of at least a mile to clear the reefs extending off it. Pilots come off from the pilot station on the eastern side of the island on the signal being made.

From the westward, if proceeding to the anchorage eastward of Diamond island, steer to pass about one mile northward of the island, rounding the buoy which marks the extreme of the shoal extending from Baroni rock, and when Alguada lighthouse opens well westward of Diamond island, bearing S. 26° W., steer for the anchorage.

To enter the river, from a position about 1¼ miles northward of the north point of Diamond island, bring Haing-gyi island summit to bear N.N.E., or, if it is visible, in line with Sand cay, southward of the island, and steer for it, which leads over the bar in about 3½ fathoms at low water (the pilots report one foot less), passing about three-quarters of a mile eastward of the black buoy, north-east of Orestes shoal, and when Pagoda point bears N.W. by W. ¾ W. alter course to pass westward of Burgess rock, leaving red buoys on the starboard and black buoys on the port hand.

The river above Haing-gyi is strictly pilotage water, and directions cannot be given.

River above Ward point.—Dalhousie or Fytche point, on the north bank of the river, 2½ miles northward of Ward point, is a bluff about 40 feet high with pagodas on it.

The northern part of Long sand, eastward of Stony point, which is nearly 3 miles north-eastward of Dalhousie point, is covered with trees about 25 feet high.

Dzen jung gli (North Travers island) and Dzen jung ji (South Travers island), on the eastern bank of the river at about 4 miles above Long sand, are about 55 and 50 feet high, respectively, and are connected by a mud bank which dries at low water. Dzen jung ji has a thin clump of trees on its summit, which is noticeable from the southward.

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* The existence of this buoy should not be depended on; in August, 1910, it was missing, and not likely to be replaced for a period.

General charts 152, 823, 830, 70.

South passage and Ridge channel, north-eastward of Dzen jung gli, are marked by black buoys, and other parts of the river above are buoyed, for which *see* continuation of river on plan.

In Bassein river, starboard hand buoys, entering from seaward, are painted red; port hand buoys black.

Tides.—It is high water, full and change, at the entrance of Bassein river at 9h. 47m.; springs rise 7½ feet, neaps 5¾ feet.

Tidal streams.—One mile northward of Diamond island the tidal streams at springs are rotatory; the flood at its commencement setting about S.S.E. ½ E., turning through east, and ending at about N.E. by E.; the ebb at its commencement setting about N.W., turning through west, and ending at about S.W.; the rate of both streams is greatest in the second and third quarters of the tide, when it is 1½ knots an hour.

Near the bar the flood stream sets about East, and the ebb about S.W. by S., at rates of from one knot to 2 knots at springs.

BASSEIN TOWN (*Lat. 16° 44′ N., Long. 94° 43′ E.*), 75 miles within Bassein river entrance, and situated in the middle of a fertile rice growing district, is resorted to by vessels principally between January and September (March being the busiest month), for the shipment of that grain for Europe. The town stands on a slight eminence on the east bank of the river, and Shwe mu htaw pagoda rises from the centre of a fort, within which are the court houses and treasury.

On the opposite side of the river is the small Theng bhaw gyeng suburb containing rice mills and store yards of the principal merchants, and a port officer resides here. Vessels of 27 feet draught can load nearly alongside the mill jetties, temporary gangways being constructed between. The population in 1901 was 31,864.

Communication.—There is regular communication three times a week with Rangoon by the steamers of the Irrawaddy Flotilla Company, the passage taking about 26 hours, and communication by railway with Rangoon and Prome. There is also telegraphic communication and a wireless telegraph station at Diamond island.

Coal and supplies.—A small supply only is kept by the Irrawaddy Flotilla Company for its own steamers; about 10,000 tons are imported annually. A coal boat holds 53 tons, and 450 tons could be put on board in 24 hours; a jetty about 50 feet in length has a depth of 30 feet at its extremity.

Supplies of fresh provisions can be obtained, also water from the mill wells.

General charts 823, 830, 70.

Plan 834, Bassein river and approaches. Var. 0° 50′ E.

Hospital.—There is a hospital for Europeans and a native hospital.

Trade.—The exports consist chiefly of rice, with small quantities of timber, horns, and hides; and the imports, coal from Australia and Bengal, gunny bags, salt, cocoanuts, and piece goods.

The climate of Bassein is relaxing, owing to the situation of the town in the delta of the Irrawaddy, and to the muddy banks of the river and creeks, which are covered during the greater part of the day. The total rainfall is sometimes over 100 inches, the greater part falling between June and September.

Health.—Cholera prevails mostly from February to May; pure water and a strictly wholesome diet are the only safeguards against it. All drinking water should be boiled. Small-pox is never widely epidemic as the Vaccination Act is in force. Vessels having no case of infectious disease for 10 days from date of departure from an infected port are allowed pratique; vessels in quarantine are allowed to load under certain conditions.

Chart 823, Koronge island to White point.

MYAUNGMYA AND PYAPON DISTRICTS.—The coastline of Myaungmya district extends from the eastern side of the entrance to Bassein river to the western side of the entrance to the Irrawaddy, a distance of nearly 40 miles, and that of Pyapon from the latter to China Bakír river. (*See* Chapter I., pages 47, 48.)

COAST.—The north shore of the Gulf of Martaban trends eastward from the mouth of the Bassein river about 70 miles, or to the vicinity of Krishna shoal, and then north-eastward for about 110 miles to the head of the gulf into which flows the dangerous bell-mouthed Sittang river. The coasts of Irrawaddy and Pegu divisions, in which is comprised the delta of the Irrawaddy, are low and wooded, and nothing noticeable is to be seen from outside the extensive shallow banks, which front them.

Banks.—From Bassein river entrance the 5-fathoms contour line on the edge of the banks off the coast trends east-south-eastward for about 52 miles, then northward of east for about 27 miles, and north-eastward to the head of the Gulf of Martaban. These banks should not be approached to less than 10 fathoms while westward of Krishna shoal.

BARAGUA FLATS, opposite the main entrance of Irrawaddy river, extend many miles from the land, which is not visible from their southernmost part.

LIGHT-VESSEL (*Lat. 15° 29′ N., Long. 95° 11′ E.*).—A light-vessel, painted red, with *Baragua* on the sides, and having one mast

General charts 830, 70.

with two red balls at the masthead, is moored in a depth of 6 fathoms southward of Baragua flats, and exhibits, at an elevation of 45 feet above the level of the sea, a *white* and *red alternating flashing* light, with a period of system of *forty-five seconds*, showing thus:—red flash, *five seconds;* eclipse, *forty seconds;* white flash, *five seconds;* eclipse, *forty seconds;* it should be visible, in clear weather, from a distance of 12 miles. (View *b*, page 337.)

Fog signal.—Two guns in succession are fired *every half hour*, at the hours and half hours, during thick or foggy weather.

Buoy.—A watch-buoy, painted black, is moored about 1¼ miles north-eastward of the light-vessel.

KRISHNA SHOAL is a narrow ridge which, within the 3-fathoms contour line, is 13 miles in length in a north-east and south-west direction, and about 3 miles across at its widest part, with depths of from 1¼ to 2¾ fathoms, over hard sand; it is separated from the eastern side of Baragua flats by a channel 3¼ miles broad, in which the depths are from 3¼ to 4 fathoms.

LIGHT-VESSEL (*Lat. 15° 36′ N., Long. 95° 38′ E.*).—A light-vessel, painted red, and with one mast, a red ball at the masthead, and *Krishna* on the sides, is moored in a depth of 4¾ fathoms at about 6 miles eastward of the south-western extreme of the shoal, or at 27 miles east-north-east of Baragua light-vessel.

It exhibits, at an elevation of 43 feet above the level of the sea, a *white group-flashing* light, with a period of system of *thirty seconds*, showing thus:—flash, *one and three-quarter seconds;* eclipse, *four seconds;* flash, *one and three-quarter seconds;* eclipse, *twenty-two and a half seconds;* it should be visible, in clear weather, from a distance of 12 miles. A blue light is burnt every half hour, between 7 p.m. and 5 a.m.

Fog signal.—A gun is fired every *half hour*, at the hours and half hours, during thick or foggy weather.

Beacons.—Upey and Pymbong beacons are situated on the south-eastern end of Pyapon island, at about 14 miles west-north-west and 12 miles north-west, respectively, from Krishna light-vessel.

CHINA BAKÍR LIGHT.—A lighthouse, built on iron screw piles, and painted red with a white lantern, in 4 feet at low water, on the edge of the flat extending off the entrance of China Bakír river, exhibits, at an elevation of 74 feet above high water, a *white fixed* and *flashing* light, showing a flash *every minute*, which should be visible, in clear weather, from a distance of 14 miles. (*Sketch on 823.*)

General charts 830, 70.

DIRECTIONS.—Rangoon river approach.—From the westward pass 5 miles southward of Alguada reefs lighthouse, and steer about E. by S. ¼ S. to pass about 7 miles southward of Baragua flats light-vessel, from which steer about E. by N. for 15 miles, and then alter course to about N.E. ½ E. for a position 5 miles eastward of Krishna light-vessel. Thence steer about N.E. to make China Bakír lighthouse, not shoaling the water to less than 4½ to 5 fathoms at low water.

A vessel working up the gulf and making China Bakír light bearing eastward of N.N.E., should at once haul to the south-eastward, and not approach the light nearer than 4 miles, until it bears westward of North.

During February and March, when thick fogs prevail, great caution is necessary in approaching Rangoon river entrance, as there is not a sufficiently marked change in the soundings in the channel to enable the position to be determined by the lead; no attempt should be made to enter the river without first sighting China Bakír lighthouse or light.

From the eastward, a vessel should be kept in depths of from 5½ to 6 fathoms at low water, until about 10 miles from China Bakír lighthouse, and in thick weather China Bakír lighthouse or light should be sighted before proceeding.

China Bakír lighthouse or light should be made between the bearings of N. by E. and W. by N.

CAUTION.—Off the coast between Bassein river entrance and Krishna shoal, especially at night and during spring tides, the lead should be frequently used and the vessel kept in a depth of not less than 10 fathoms at low water, and in shaping course allowance should be made for the set of the tidal streams and for an indraught, during the rising tide, into the mouths of the Irrawaddy. The ground log should be used.

It should also be borne in mind that it is high water at Alguada reef about 6 hours earlier than at China Bakír lighthouse, when calculating the time and turn of the stream in any position between those places.

The land at the river entrance, being very low, is not visible from seaward until about 7 miles from the shore, and in depths of 4½ to 4½ fathoms at low water. It is necessary to guard against being set to the eastward of Rangoon river, as the flood stream runs very strongly over the sands at the entrance of Sittang river.

Outer anchorage (*Lat. 16° 18′ N., Long. 96° 18′ E.*).—If of moderate draught, after making China Bakír lighthouse or light, steer north-eastward until it bears W. by S., distant about 6½ miles, then anchor in about 3½ fathoms at low water; but if over 18 feet draught anchor in 4½ fathoms at low water, with China Bakír lighthouse bearing N.W., distant 5 miles.

Tides.—It is high water, full and change, at China Bakír lighthouse at 3h. 3m.; springs rise 16 feet, neaps rise 11 feet.

Tidal streams.—Between Alguada reefs and Rangoon river entrance, the flood stream sets eastward, and follows the trend of the edge of the flats. At springs, during the North-east monsoon, its rate is 2 to 4 knots, increasing in strength off the river entrance. The ebb stream is stronger than the flood.

Occasionally in October and November a steady westerly set is experienced; quite overcoming the flood stream. During November, December, and January there is little or no flood stream southward of Alguada reefs, except at spring tides. *See* page 484, and *tidal diagrams on chart 823.*

Winds.—At Rangoon river entrance in December the wind is north-easterly, veering eastward and blowing fresh during the day; the weather is generally fine. In January the wind is more northward, and sometimes there is a strong easterly wind for several days; towards the end of the month light land and sea breezes commence; the weather is thick and hazy.

In February land and sea breezes are regular, the latter being fresh near the shore; thick fogs prevail. In March light land and sea breezes continue, and the weather is foggy. The sea breeze is generally strongest at the time of spring tides.

The South-west monsoon commences about the middle of April, and after a few stormy days the weather is clear until the beginning of May, when the monsoon has fairly set in, and continues with breaks of a few days of fine weather until the end of October.

China Bakír river.—*See* page 471.

HANTHAWADDY DISTRICT.—The coastline of Hanthawaddy district extends in a north-easterly direction for a distance of about 40 miles between China Bakír and Sittang rivers, Rangoon being the port. (*See* Chapter I., page 49.)

Plan 833, Rangoon river and approaches.

RANGOON RIVER (*Lat. 16° 30′ N., Long. 96° 20′ E.*), a branch of the Irrawaddy, known in the north as the Myitmaka, rises in the mountainous district of Prome in Upper Burma, in lat. 18° 50′ N., long. 95° 25′ E., and for a distance of 150 miles flows south-south-eastward and nearly parallel to the Irrawaddy river. At about 50 miles from its mouth it takes a more easterly direction, and under the name of Hlaing river is joined by several large creeks;

the chief of which are Panhlaing creek, Pegu river, and Bassein creek; this portion of the river is navigable by steam vessels of light draught.

Below the Panhlaing or Pan-y-can creek it is known as Rangoon river, and separates the city and cantonments of Rangoon from the dockyard suburb of Dala, which is on the south bank close to the entrance to Twante canal; it flows from this in a south-easterly direction, entering the Gulf of Martaban between Elephant point and Eastern Grove lighthouse.

Ocean steamers can ascend the river to Rangoon, but no higher, and skilled navigation is required for the 21 miles between Rangoon and the sea.

The land at the entrance is low, and for the most part covered with jungle, forming mangrove and tidal forests, and there is but little cultivation. Owing to the great rise and fall of tide, and the rapidity of the tidal stream, the water is charged with a large quantity of deposit, and the river is a deep yellow colour.

Western side of entrance.—Lekogon pagodas, situated on the coast about 4 miles north-westward of China Bakír lighthouse, consists of a group of small pagodas, standing close together, and being of a brown colour and about the same height as the surrounding groves of tree, are not easily recognised. (*View on 833.*)

From Lekogon pagodas the coast trends in a north-east direction for about 13 miles to Elephant point, and is first belts of thick forest jungle and grass, and afterwards mangrove trees, with some cultivated land between. A clump of trees, charted about 3½ miles south-westward of Elephant point, is not easily recognised.

China Bakír flats, on the western side of which is the entrance to China Bakír river, dry at low water to an average distance of 2 miles from the land, and extend 4¾ miles southward of the coast at Lekogon pagodas, their southern part being about 2¼ miles wide, and similar flats border the coast to Elephant point, at distances of from 1¾ to 2 miles off, the edge from Elephant point having a south-east direction for a distance of 2 miles; this latter portion of the flat is named Spit sand.

Some beacons, used in the survey, stand on the flat, and tide gauges are situated on its edge, at about 6¼ miles south-south-west and 3 cables east-south-east of Elephant point.

Elephant point (*Lat. 16° 29′ N., Long. 96° 20′ E.*) is very low, with some houses, a flagstaff, and a few tall palm trees near it.

LIGHTS.—Two *white fixed* lights, which are 80 yards apart, and in line bear about N. 69° W., are shown from posts on Elephant point, at elevations of 15 and 33 feet respectively above high water; their positions are altered to meet changes in the channel. The lights should be visible, in clear weather, from a distance of about 5 miles.

Signal station.—The signal station, situated 3½ cables south-south-west of the light posts on Elephant point is the property of the Indian telegraph department, and can signal messages or orders by means of the flags of the International code.

Storm signals are shown from the signal station flagstaff. *See* Chapter I., pages 74-76.

Eastern side of the entrance.—Grove point, situated about 2¾ miles north-eastward of Elephant point, is also low.

LIGHT (*Lat. 16° 30′ N., Long. 96° 23′ E.*).—About 8 cables eastward of Grove point, the eastern entrance point of Rangoon river, and one hundred yards below high water mark, is Eastern Grove lighthouse, built on iron screw piles, 105 feet in height, and painted red with a white lantern, which exhibits, at an elevation of 93 feet above high water, a *white occulting* light, with a period of system of *ten seconds*, showing thus:—light, *eight seconds;* eclipse, *two seconds,* and should be visible, in clear weather, from a distance of 15 miles between the bearings of N. 34° E. and S. 34° W. A faint light is visible between N. 34° W. and N. 56° W. (*Sketch on 823.*)

Eastern Grove flats.—The south-west edge of these extensive flats of mud and sand, which dry at three-quarters ebb, stretches in a south-east direction for a distance of 6 miles from Grove point, outside which the edge of a shoal, not defined, trends to the eastward at a distance of about 8 miles from the shore.

Eastern sands, which lie on the eastern side of the entrance, and nearly 4 miles south-south-east of Grove point, are about 2 miles in length in a north-north-west and opposite direction, and a mile in width; portions of the sands dry at low water, spring tides, the highest part being 4 feet above water. The shoal on which they stand extends about 3 miles south-west, and this part is named South-west tail; shoal water also extends about a mile south and 2 miles east of the south point of Eastern sands.

The shoal water to the northward curves to the north-westward, and at 1½ miles is another large patch which dries 4 feet; from this the shoal water occupies nearly the middle of the river for 2 miles north-westward, to the eastern end of Middle bank (Alle Thoung), which is about 3 miles in length in a west-north-west direction, and dries 8 feet.

There is a heavy sea on these outer dangers during bad weather.

Leading lights.—Two small *white fixed* leading lights are exhibited from masts on the south bank of the river, about half a mile west-north-west of Pila Kuh Chaung (Deserters creek), at elevations of 20 and 40 feet, respectively, above high water; they are 106 yards apart, and when in line, bearing N. 71° W., lead between Elephant point and Middle bank.

Entrance.—The entrance to the river, between the edge of the flat off the western side, and the south extreme of Eastern Grove flats, is about 6 miles in width, but Eastern sands, which dry, with the shoals surrounding it, occupy the greater part of the centre and eastern side of the entrance, dividing it and forming Western and Eastern channels.

The Western channel lies along the edge of the 3-fathoms contour line of the narrow fringe of shoal water off the flat on that side, and the narrowest part between it and the similar contour line of the shoal extending about 7¼ miles south-westward of Eastern sands, is a third of a mile in width, at nearly mid distance between China Bakír lighthouse and Elephant point; within this the channel widens.

The Eastern channel between the 3-fathoms contour line on the east side of Eastern sands and the western edge of Eastern Grove flats is about 4 cables at its narrowest part a mile north-eastward of Eastern sands; but this channel is not buoyed, nor is it used for navigation.

CAUTION.—Changes in the depths and in the position of the banks in Rangoon river and its entrance are so frequent that the plan and directions can never be absolutely relied on. The buoys and light-vessels are moved as necssary to mark the channels.

Depths.—A shoal with a depth of 18 feet over it lies in mid channel of the narrowest part at the entrance to Western channel, otherwise the depths are 19 feet, but shoaling is reported in this locality; the depths increase further in with from 40 to 75 feet off Elephant point.

There is a depth of 21 feet at the entrance to the Eastern channel.

Monkey point channel, between Hastings sand and shoal on the south and Monkey point on the north, is dredged to a depth of 15 feet on the line of the leading marks; in 1906 H.M.S. *Terrible*, drawing 30 feet, one inch, entered the port of Rangoon.

SPIT LIGHT-VESSEL (*Lat. 16° 27′ N., Long. 96° 22′ E.*).—A light-vessel, painted red, with *Spit* on the sides, is moored, in 24 feet water, on the eastern side of the Western channel, 2¾ miles south-eastward of Elephant point, and exhibits, at an elevation of 50 feet above the level of the sea, a *white fixed* light, which should be visible, in clear weather, from a distance of 12 miles. The vessel is shifted to meet the changes in the channel.

Buoy.—A red conical watch buoy is moored north-north-eastward about a cable from the light-vessel.

Plan 833, Rangoon river and approaches. Var. 0° 50′ E.

Buoyage.—Between the sea and Rangoon, the channel is marked by red buoys on the starboard hand and black buoys on the port hand, entering from seaward.

Light buoys and buoys (*Lat. 16° 17′ N., Long. 96° 16′ E.*).—The fairway buoy at the entrance to the western channel, painted black and white in horizontal stripes, exhibits a *white fixed* light, and is moored in 21 feet water, 5 miles eastward of China Bakír lighthouse.

The western channel is marked on its western side by seven buoys, painted black, as follows:—

Lower Western buoy, can, in about 20 feet.

Centre Western, conical, in about 19 feet.

Upper Western, conical, in about 21 feet.

Lower Spit, can, in about 24 feet.

Centre Spit, exhibits a *white fixed* light, is moored in about 35 feet at $2\frac{4}{10}$ miles south-eastward of Elephant point.

Intermediate Spit, can, in about 20 feet.

Upper Spit, conical, in about 24 feet.

The eastern side of Western channel is marked by four buoys, painted red, as follows:—

Lower Eastern buoy, conical, and surmounted by a diamond, in about 17 feet, 4½ miles eastward of Lower Western buoy.

Centre Eastern, conical topped, in about 15 feet, nearly 2 miles eastward of Upper Western buoy.

Upper Eastern, conical topped, and surmounted by a triangle, in about 30 feet, $1\frac{2}{10}$ miles eastward of Lower Spit buoy.

Upper Ridge, conical, in about 25 feet, $1\frac{2}{10}$ miles eastward of Elephant point.

The south-west edge of Middle bank is marked by four buoys, painted red, as follows:—

Lower Middle bank, conical, is nearly half a mile north-north-west of Elephant point.

Centre Middle bank, conical and surmounted by a diamond.

Intermediate Middle bank, conical and surmounted by a St. Georges cross, marks an extension of Middle bank.

Upper Middle bank, conical.

Pilots.—The pilot brig, painted white, and carrying a red and white horizontally-striped flag, is usually at the pilot's cruising station, 8 to 9 miles eastward of China Bakír lighthouse. (*Sketch on 833.*) At night the pilot brig shows the following lights:—

(1) When at anchor at the station on pilotage duty:—a *white fixed* light at the starboard fore topsail yard-arm, at an elevation of 43 feet above the level of the sea, and a similar light at the stern, 15 feet below

the preceding one; a flare-up light or lights will also be shown at short intervals of not more than 15 minutes.

(2) When under way and at the station on pilotage duty:—a *white* light at the main-topgallant masthead, visible in all directions, and also a flare-up light or lights as in (1).

(3) When not engaged at the station on pilotage duty:—the usual navigating lights are shown.

Vessels over 100 tons are obliged to take a pilot. The pilots do not come out to the outer anchorage, but vessels there must get under way when there is water enough, and pick up the pilot at the pilot brig.

Tides.—It is high water, full and change, at Elephant point at 3h. 32m.; springs rise 19 feet, neaps 13 feet.

The rise and fall of tide given above is for the dry season or from December to March; during the rains at springs, the rise at Elephant point sometimes amounts to 21 and 22 feet.

The tides of Rangoon river are subject to a large diurnal inequality, which may either accelerate or retard the times of high and low water, sometimes as much as more than an hour.

From September to March the night tides are higher than the day tides in December and January, at springs, the difference is about 2 feet.

From March to September the day tides are higher than the night tides; the difference is greatest in June and July at springs.

Tidal streams.—At springs in the more confined parts of the channel into Rangoon river and along both shores of the Gulf of Martaban the tidal streams are rapid, running from 5 to 7 knots.

After the rains, the tidal streams outside Rangoon river have a rotatory motion; the first of the flood sets eastward, at half flood it sets north-eastward, and towards the end of the flood northward; the ebb at its commencement sets westward, and it changes gradually through south to south-eastward.

There is no slack water, the streams continuing at a rate of 1½ to 2 knots.

In the Western channel the flood sets north-east along the shore as far as Upper Western buoy, when it turns gradually northward into the river; its rate is from 5 to 6 knots at springs. The great body of the flood passes eastward into Sittang river; and in the Eastern channel the flood is comparatively weak, setting north-westward, and makes from 20 minutes to 30 minutes later than in the Western channel.

Inside Elephant point (*Lat. 16° 29′ N., Long. 96° 20′ E.*), on the western side where the channel is confined by Middle bank, the flood runs about 6 knots at springs, its rate decreasing as the northern part of Middle bank is passed.

The ebb stream sets south-westward in the Western channel outside Elephant point; and south-eastward in the Eastern channel, with a rate of 6 knots at springs, gradually altering its direction south-westward, as it sweeps round the south-eastern edge of Eastern sands. Inside the river the stream generally takes the course of the channel, and there are strong eddies off the various points during spring tides.

The tidal stream is strongest on the night of the second day after full or new moon; it then runs in the channels at the rate of 7 knots an hour, with only a few minutes slack water. After neaps the streams gradually increase in strength, and are rapid until the moon quarters, when they suddenly slacken; on the second and third day after the moon's quartering there is slack water on the flood for 1½ hours, and on the ebb for one hour.

The flood tide at springs makes suddenly and rises 6 feet in the first hour; the ebb stream, however, still continues running in mid-channel, and it is not slack water until one hour after the water has commenced to rise. The flood stream turns earlier in-shore than in mid-channel.

During the rains, or from June to September, inclusive, the flood stream is weaker and the ebb stronger than during the remainder of the year, and at times vessels do not swing to the flood off the city of Rangoon.

Caution.—At half flood, when the banks are covered, the stream after passing Upper Western buoy runs over Spit sand directly towards Elephant point. The ebb stream sets from Centre Spit buoy across the channel on to a part of Eastern sands.

RIVER ABOVE ELEPHANT POINT.—Hmawwun Lumps (*Lat. 16° 34′ N., Long. 96° 15′ E.*), off the mouth of Hmawwun Chaung, a creek on the east bank about 7 miles north-westward of Grove point, has 11 feet water over it at low water, and is about three-quarters of a mile westward of the western edge of a sand flat, which dries 8 feet and lies off the mouth of Hmawwun creek.

Buoy.—The south-western side of Hmawwun Lumps is marked by a conical buoy, painted red, and moored in a depth of about 20 feet about 1½ cables from the shoal.

Bassein creek, which flows south-westward into China Bakír river, has its entrance on the western bank of Rangoon river, at 10 miles north-westward of Elephant point.

Beacons.—Between Elephant point and Bassein creek are the following beacons, with their respective distances from Elephant point:—Tree beacon, 1$\frac{4}{10}$ miles; Motjua beacon, a tripod surmounted by a ball, and painted white, $3\frac{6}{10}$ miles; and Hmawwun beacon, a mast, surmounted by a ball, painted black, $7\frac{2}{10}$ miles.

On the east bank of the river opposite Bassein creek is South beacon, painted white, and surmounted by a basket.

Da Silva shoal, the southern extreme of which, with a depth of 7 feet, is $1\frac{6}{10}$ miles north-eastward of Bassein creek, has a least depth of 4 feet over it, at about a third of a mile northward of its south extreme; the eastern edge of this shoal has extended in an easterly direction, and is steep-to on its east side, there being only a depth of 8 feet close westward of the line of Syriam Great Pagoda in one with the Umbrella tree.

Choki Lumps shoal, about three-quarters of a mile in length in a north-north-west and opposite direction, and one cable in width, has a least depth of 11 feet over its central part; its south-east extreme is 3 cables northward of Da Silva North point, and its north extreme is about the same distance southward of Choki point on the east bank of the river, with detached patches between.

Buoys.—The south-west side of Choki Lumps shoal is marked by two conical buoys, painted red.

A conical buoy, painted black, is moored on the eastern side of an 18-feet patch, 4 cables westward of the northern of the above buoys.

Devils Hole leading lights (*Lat. 16°39′ N., Long. 96°16′ E.*).—About a third of a mile north-north-west of Devils Hole creek, which is situated on the east bank, about one mile northward of the south extreme of Da Silva shoal, three *white fixed* leading lights are exhibited from masts, one, as a rear light, being for use with either of the others as front lights.

Choki point leading lights.—At Choki point, on the east bank, two *white fixed* leading lights are exhibited from masts; they are one cable apart.

Da Silva point leading lights.—Two *white fixed* leading lights are exhibited from masts, situated about 6½ cables westward of Da Silva North point; they are 133 yards apart.

All the above are lantern lights.

The southern of Devils Hole front lights in line with the rear light, bearing N. 14° E., leads eastward of Da Silva shoal.

Choki point leading lights in line, bearing N. 33° W., lead north-eastward of the northern part of Da Silva shoal, in about mid-channel.

The northern of Devils Hole front lights in line with the rear light, bearing S. 64° E., leads northward of Da Silva North point, and between it and Choki Lumps shoal.

Da Silva point leading lights in line, bearing S. 7° E., lead westward of Choki Lumps shoal, in mid-channel, and between Liffey island and shoal and the east bank of the river.

Plan 833, Rangoon river and approaches. Var. 0° 50′ E.

Beacons.—Between Da Silva North point and Kings point are the following beacons:—A beacon, consisting of a mast surmounted by a ball, painted black, at 7 cables westward of Da Silva North point.

West Harbour beacon and Old West Harbour beacon, distant one mile and one cable, respectively, south-south-east of Kings point.

On the eastern bank two beacons are situated northward of Devils Hole creek, the north-western surmounted by two black balls, and the south-eastern a mast, painted red, and surmounted by one ball.

North beacon, with a square board, about a cable northward of the north-western of the preceding beacons.

A beacon consisting of a mast surmounted by a ball at Choki village.

Tree beacon, surmounted by a ball, about 3 cables south-eastward of Choki point.

Two beacons, painted red, and East Harbour beacon, on the eastern bank, abreast the middle of Liffey island.

Two beacons, painted red, and Old East Harbour beacon, on the eastern bank, abreast the south end of Hastings sand.

There are also several survey beacons which will be seen on referring to the plan.

Liffey island (*Lat. 16° 44′ N., Long. 96° 12′ E.*).—The western bank of the river has a general north-north-west direction from Da Silva North point for 6 miles to Kings point, and about 1⅓ miles south-eastward of the latter point is the north end of Liffey island, covered with grass, which is rather more than one mile in length in a north-north-west and opposite direction; a strip of shoal water extends down the centre of the river from the south point of the island for a distance of nearly 3 miles.

Beacon and buoy.—A mast beacon is situated on middle of the western side, and a conical buoy, painted black, is moored off the middle of the eastern side of Liffey island.

Plan, Port of Rangoon, on 833.

Hastings sand lies between the north end of the sand extending northward of Liffey island and Monkey point; it is in the form of an inverted L, its side in a north and south direction being 8½, and its side east and west, 6½, cables in length, the general breadth being about a quarter of a mile; it dries 6 feet in places, and on its western side is a detached patch which dries one foot.

Beacon and buoy.—A beacon stands near the south point of Hastings sand.

Lower Hastings buoy, conical and painted black, marks the edge of the shoal water on the eastern side of Hastings sand.

Hastings shoal (*Lat. 16° 47′ N., Long. 96° 12′ E.*), with 6 feet water over it, is about a quarter of a mile in length, in an east and west direction, and half a cable in width; it lies about 2 cables northward of the western end of Hastings sand, on a shallow flat, with depths of from 8 to 17 feet over it, frequently changing, which is 1½ miles in length in an east and west direction, and almost completely fills the entrance to the port, between Hastings sand and Monkey point and the river bank westward of it.

Light buoy (*Lat. 16° 46′ N., Long. 96° 12′ E.*).—The southern part of the eastern edge of the flat is marked by a conical buoy, painted black, and exhibiting a *white fixed* light; it is situated about one cable north-eastward of the north-east elbow of Hastings sand.

Monkey point buoy, conical, painted black, and surmounted by a staff and ball, is on the eastern edge of the flat, and marks the south side of Monkey point dredged channel.

Pazundaung buoy, conical, painted red, and surmounted by a staff and triangle, is also on the eastern edge of the flat, and is moored on the northern side of Monkey point channel.

Light buoy.—A wreck buoy, painted green, and exhibiting a *green fixed* light, is moored on the northern side of a wreck which lies about 1½ cables north-eastward of the eastern end of Hastings shoal.

Channels.—There are three channels across the shallow flat between Hastings sand and Monkey point; the southernmost of these is entered northward of the light-buoy north-east of Hastings sand, and between it and Monkey point buoy, passing northward of Hastings shoal.

Monkey point channel, the middle of the two, is dredged to a depth of 14 feet, and has 15 feet on the line of the leading marks; it passes northward of Monkey point buoy, and between it and Pazundaung buoy.

Leading lights.—Two *white fixed* leading lights, 1$\frac{2}{10}$ cables apart, are exhibited at elevations of 40 and 60 feet above the river, respectively, from masts, situated 1¾ cables southward of Syriam point oil pier, and when in line, bearing about N. 74° E., lead through the southern channel and northward of Hastings shoal.

Beacons.—There are three sets of beacons on Syriam point; the southernmost pair are surmounted by single white diamonds, the middle pair by single white discs, and the northernmost by two white diamonds. These spar beacons are in line bearing S. 75° E., S. 76½° E., and S. 77½° E.

Syriam flat, and the shoal water extending from it, is situated north-westward and northward of Syriam point, from which the south point of the shoal is distant 1½ cables in a west-north-west direction; the edge of the shoal then curves round to the north-eastward, and, with Syriam flat, is distant 3 cables from the south-east bank of Pegu river.

Plan of Port of Rangoon on 833. Var. 0° 50′ E.

Buoy.—The western edge of the shoal is marked by a conical buoy, painted red, and situated about 6 cables north-westward of Syriam point.

Examination anchorage.—The examination anchorage, in which the depths are from 47 to 82 feet is in a space south-eastward of Da Silva North point, northward of a line drawn West (true) from Devils Hole rear leading light mast, the northern limit of the anchorage being a line drawn N. ⅝ E., from Da Silva North point, across the river.

Anchorage.—Buoys.—The anchorage for merchant vessels, north-westward of Hastings shoal, is marked by eight cask buoys, painted red and white in stripes, and moored north-westward of that shoal.

Port of Rangoon.—The port extends from about 1½ miles westward of Monkey point, in that direction for fully 2 miles, with widths of from 2½ to 4 cables, and depths of from 21 to 36 feet in the eastern, and from 36 to 82 feet in the western, part, northward of Mill point.

Mooring buoys.—There are 11 mooring buoys off the town, and vessels secure, with their own cables, to the pendants. The position of the buoys will be seen on the plan.

Alun sand, which dries, and the shoal surrounding it, occupies about 1¼ miles of the north bank of the river, from, and westward of, opposite Mill point; it extends about 7 cables from the north bank.

Buoys.—The south extreme of the shoal extending from Alun flat is marked by a conical buoy, painted red, moored in 10 feet water.

Plan 833, Rangoon river and approaches.

Directions.—From the Fairway buoy a N. ½ W. course will lead to the entrance to the Western channel, about one mile eastward of Lower Western buoy, when the course is about N.N.E. for the Centre Western buoy, observing that this is the narrowest part of the channel, and that the depths are uncertain, and a shoal, with a depth of 13 feet over it, is reported to exist about 3 cables south-east of the Centre Western buoy, and that the water is said to be shoaling in this locality.

After passing Centre Western buoy, the Spit light-vessel, if seen, may be steered for, bearing N.E. by N., which should pass about a quarter of a mile eastward of Lower Spit buoy, and to about the same distance south-eastward of Centre Spit light buoy, from which the course is to the northward and north-westward, passing eastward of Intermediate and Upper Spit buoys.

Elephant point (*Lat. 16° 29′ N., Long. 96° 20′ E.*) may be passed at a cable distant, avoiding the northern elbow of the shoal of Spit sand, and if the light posts can be distinguished, in line bearing N. 69° W., they lead along the south edge of Middle bank (buoys, page 458), until abreast of Pilá Kuh Chaung, when the pecked line on the plan should be followed, the courses being about N.W. ¼ W. to Motjua, then N.N.W. ¾ W. to about half a mile south-east of Deep-water point, and N.N.W. to mid-channel between Hmawwun beacon and Hmawwun Lumps.

Syriam Great Pagoda, open westward of North beacon (square board), bearing about N. 8° E., leads up the channel until nearing South beacon (page 461), when the vessel should be kept more to the eastward to bring Syriam Great Pagoda in line with the beacon surmounted by two balls, and close south-eastward of North beacon, bearing about N. 5° E., which leads between Da Silva shoal and the eastern side of the river, remembering that the bank on which Da Silva shoal stands is steep-to and extending eastward, with only 8 feet close westward of the clearing mark.

Continue this course till nearly abreast Devils Hole creek, when Shwedagon pagoda, gilded from base to summit and situated northward of Rangoon (*sketch on plan 833*) should be brought in line with Choki point, bearing N. 36° W., and steering on this mark leads from 2 to 3 cables from the eastern bank, to abreast Choki village, when alter course to about W. ¾ N. to pass about 1½ cables northward of Da Silva North point, with Keikmalong clump, situated 2¼ miles eastward of North beacon, in line with the beacon mast surmounted by a ball at Choki village, bearing S. 77° E., astern, which leads southward of Choki Lumps. (Buoys, page 461.)

Having passed southward of Choki Lumps red buoy, the two beacons (front square board, rear mast and black ball), three-quarters of a mile westward of Da Silva North point in line, bearing S. 8° E., used as a stern mark, should lead eastward of the 16-feet patch, marked by a black buoy, and up the channel, but these marks lead close to the eastern edge of Liffey island shoal; the eastern bank of the river is, however, clear of danger beyond the distance of a cable, and the vessel may be kept more towards that side when approaching Liffey island. *See* Signals below.

Choki point (*Lat. 16° 41′ N., Long. 96° 12′ E.*), bearing S. 20° E., with the western bank south-eastward of Da Silva North point, just shut in, leads just eastward of Liffey island shoal and Hastings sand.

Whilst approaching Syriam point ascertain the rise of tide by the tidal semaphore at Kings point before proceeding through Monkey point channel. For signals, *see* page 466.

From south-westward of Syriam point, steer north-westward, leaving Lower Hastings buoy on the port hand, and having passed eastward of the light buoy, north-east of Hastings sand, proceed into the port through the most convenient of the channels over the flat,

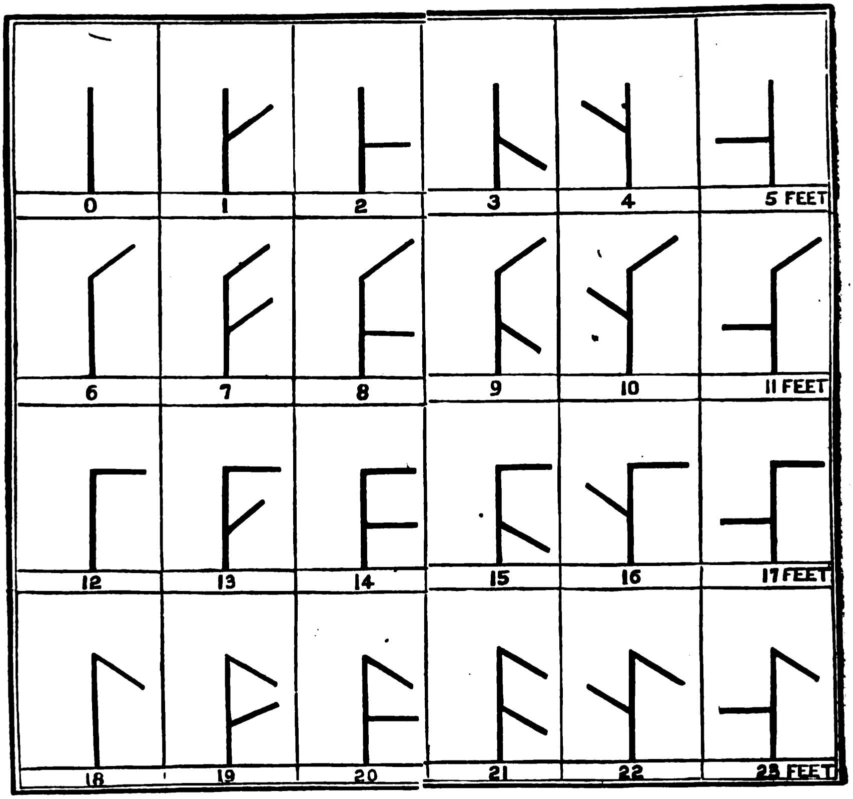
Plan of Port of Rangoon on 833. Var. 0° 50′ E.

already mentioned, with the pair of beacons, marking its fairway, in line, but if passing through Monkey point dredged channel, observing that dredgers may be at work in it.

Monkey point channel.—Signals.—Vessels intending to enter the port through Monkey point channel during the day time, are required to hoist a black ball or shape, about 2 feet in diameter, half mast on the port side of the mainmast, when passing Choki point, lowering the same for the information of outward-bound vessels, should any change take place regarding such intention.

Tide gauges.—In addition to the tide gauge at Elephant point, others are situated at Choki point, surmounted by a pole and basket; at about 2 cables south-east of Kings point, and immediately westward of Monkey point.

Tidal signals (*Lat. 16° 46′ N., Long. 96° 10′ E.*).—On the bank of the river at half a mile below Kings point, south-eastward of Rangoon, a tidal semaphore indicates the tidal rise above low water, spring tides, as follows, the signals as given being when seen from the southward, and show the reverse way in Rangoon reach.



General charts 823, 830, 70.

Plan of Port of Rangoon on 833. Var. 0° 50′ E.

A lower arm of the semaphore shows each rise of 3 inches of tide above zero, thus: Arm upward, 3 inches; arm horizontal, 6 inches; arm downward, 9 inches.

Tides.—It is high water, full and change, at the Port officer's wharf, Rangoon, at 4h. 35m.; springs rise 19 feet, neaps 14 feet, during the dry season, December to April; but during the rains, springs rise 21 to 24 feet.

Tidal streams.—The rate of the tidal stream is from 5 to 6 knots at springs.

Inner navigation.—For the navigation of the Irrawaddy above Rangoon, *see* pages 469-483.

RANGOON (*Lat. 16° 48′ N., Long. 96° 10′ E.*), the chief city and port in Burma, is 21 miles from sea by the course of the river. The city, with the suburbs of Kemmendene and Pazundaung, lies on the north bank, and behind the array of wharves and warehouses are the buildings of the mercantile or business quarter, from which the ground slopes upwards, through a wooded cantonment, to the fort of a slight eminence crowned by the great gilded Shwedagon pagoda. On the south bank are the suburbs of Dala, Kamakasit, Kanaungto, and Seikgyi, a narrow strip of dockyard premises and native huts.

The city contains several handsome buildings, amongst which are the Government house, the Roman Catholic Cathedral, the Jubilee Hall, the Town Hall, the College, the general hospital, &c., and in 1901 had a population of 234,881; it is at present lit with oil lamps, but electric light will probably be introduced at an early date.

Communication.—The British India S.N. Company have weekly services of steamers between Rangoon and Negapatam, calling at Madras and other ports; with Calcutta, Penang, and Singapore; with Calcutta, viâ Chittagong and other ports; with Cocanada, calling at intermediate ports; and with Tavoy and Mergui; they have also fortnightly steamers to Bombay, viâ Colombo. River steamers run weekly to Mandalay and fortnightly to Bhamo, the limit of steamer navigation, 800 miles from the sea.

It is the terminus of all the railway lines in the Province. The lines to Prome and Bassein pass westward between the municipality and the cantonment, with several stations within the city limits, and frequent local trains.

The main line to Mandalay and Upper Burma runs generally eastward from the terminus, and, skirting the side of Pazundaung creek, passes north-eastward into Hanthawaddy District.

General charts 823, 830, 70.

Plan of Port of Rangoon on 833. Var. 0° 50′ E.

An electric tramway runs east and west through the heart of the business quarter, and northward to Shwedagon pagoda.

Telegraphic communication with all parts.

Coal and supplies.—About 30,000 tons of coal are kept in stock, and about 220,000 tons are imported annually. Coaling is carried on from lighters or boats, as the coal jetty will only accommodate small craft, and from 500 to 1,000 tons can be put on board in 24 hours. The Burma Oil Company keep about 20,000 tons of liquid fuel in stock, and 150 tons could be pumped in an hour.

Supplies of fresh meat, vegetables, and bread can be obtained, and water from a tank vessel or at the Port officers' wharf.

Patent slip.—*See* Appendix, page 566.

Wharves.—Alongside Brooking wharf the depth is 25 feet at low water springs; at Phayre street wharf, 20 feet; at Soolay Pagoda wharf, 24 feet; at Latter street wharf, 21 feet. These wharves are under the Port Commissioners, and are connected with the railways.

Repairs.—Large repairs can be made to hull, machinery, and boilers by the Irrawaddy Flotilla Company, Limited, who have sheers capable of lifting 10 tons.

Hospital.—Sailors' home.—There is a hospital to which seamen are admitted, and a Sailors' home.

Time signal (*Lat. 16° 46′ N., Long. 96° 10′ E.*).—The time signal made from the square tower of the Mayo Marine Institute, at an elevation of 81 feet above high water, consists of a black ball, hoisted close up at 11h. 55m. 0s. every day, except Sundays, is dropped at 0h. 0m. 0s. Rangoon mean time, which is equivalent to 17h. 35m. 20s. Greenwich mean time.

A gun is also fired (Sundays excepted) at noon Rangoon standard time, which is 5m. 20s. before Rangoon mean time; it is situated close to the time signal. If the ball is incorrectly dropped, it will be hoisted to the masthead immediately, or if it fails to drop, it will remain at the masthead, and in either case it will be dropped at 1h. 0m. 0s. Rangoon mean time.

Storm signals are shown from a flagstaff near the Custom house at Rangoon. *See* pages 74-76.

Trade.—The exports are rice, teak timber, raw cotton, raw caoutchouc, cutch, raw hides, jadestone, horns, pulse, and paraffin wax. The imports are coal, salt, cotton, both twist and yarn, piece-goods. In 1903-04 the imports were valued at R.14,24,68 and the exports at R.17,54,56.

The city is famous for its carvers in wood and ivory, and for the beauty of its silver work; there are about fifty rice mills, twenty saw-mills, and a petroleum refinery.

Chart 70, Bay of Bengal.

PEGU RIVER, which flows into Rangoon river, eastward of the city of Rangoon, rises in the southern slopes of Pegu Voma, and

General charts 830, 70.

after a south-south-easterly course of about 50 miles to Pegu, where it is 105 yards broad, and is spanned by a bridge, it trends southward for about 15 miles, and then south-westward for 35 miles to Rangoon.

At Pegu, in the dry season, the river is almost dry at low tides, when the tidal rise is 4 to 5 feet. On the east it communicates with Sittang river by several channels, that of Paing kiwon forming a canal between the two rivers; a canal also leaves the Paing kiwon some distance east of Kyaik padaing, and joins the Sittang at Myitkyo.

Bore.—A bore about 3 feet high sweeps up Pegu river, especially in February, March, and April, and its effects are felt at Pegu in the sudden rising of the early flood. During the rains steam navigation is carried on in connection with Toungoo.

Pazundaung creek also rises in the southern slopes of the Pegu Voma, and after a southerly course of about 53 miles, joins Rangoon river just below the city of Rangoon, where its mouth is about 2 cables in width; it is navigable for boats for a distance of about 40 miles. Thirty-five miles above Rangoon it is 50 feet broad, flows between high steep banks, and has a depth of 3 feet during the dry season, with a tidal rise of 1½ feet; towards its mouth, the banks are steep and muddy.

INNER NAVIGATION.—Irrawaddy river is full of islands and sandbanks, many of which are submerged during the rains, and the left bank then suffers from inundations. The river is navigable at all seasons by steamers drawing 4 feet, as high as Bhamo, or some 800 miles from the sea; and during the dry season for steamers drawing 6 feet as far as Thayetmyo, 364 miles from Rangoon. *See* page 474.

In the rains, steamers and large boats enter the main stream of the Irrawaddy from Rangoon by Panhlaing or Bawle creeks; but during the dry season it is necessary to descend Rangoon river for some distance, and, passing through Bassein creek enter the Irrawaddy through the inner part of China Bakír river.

From Mandalay (*Lat. 22° 0′ N., Long. 96° 1′ E.*) to the junction with China Bakír river in lat. 17° N. the general width of the Irrawaddy varies from 500 to 3,000 yards, its banks being generally wooded and well defined. No rules can be laid down for its navigation, as changes frequently take place, but the pilots are intelligent and trustworthy.

Two miles below Akauktaung, on the right bank of the river, is a remarkable cliff, covered with images of Buddha carved out of the rock; it is about three-quarters of a mile in length, and rises 400 feet sheer out of the river, and is the first high land met with when ascending. Here the stream runs with great strength, as much as 7½ knots having been experienced in August.

Chart 70, Bay of Bengal. Var. 0° 50′ E.

The river has been ascended in the month of July from Rangoon to Thayetmyo (*Lat. 19°36′ N.*) by a vessel drawing 10 feet 2 inches water. The track taken was through Panhlaing creek, which joins the main river at Yandun, about 60 miles above Rangoon; the same vessel descended the river and reached Rangoon through China Bakír river and Bassein creek. The navigation of the main stream in July was easy, and there was sufficient water in it for a vessel drawing 15 feet.

Sketch of the Irrawaddy river, 2135.

Routes.—To reach the main river from Rangoon, the route by Panhlaing creek is recommended when ascending the river, as it is 67 miles shorter than that by Bassein creek, and has a depth of about 15 feet in July, or at average high flood, but only about 7 feet during the dry season; the creek is, however, narrow and intricate, and at the point of junction with the main stream is so tortuous that only steam vessels fitted with twin-screws or large additional rudders could turn. Panhlaing creek is not used by steam vessels when descending the river, on account of the difficulties at this point.

The route by China Bakír river and Bassein creek is used by large steam vessels on their downward trip, being much less obstructed than Panhlaing creek, and having almost always a sufficient depth of water for vessels drawing not more than 6 feet, at high-water neaps.

Chart 823, Koronge island to White point; sketches of Irrawaddy river, 2135, 2136. Var. 0° 50′ E.

Bassein creek (*Lat. 16° 36′ N., Long. 96° 14′ E.*) dries in many places at low water, but by entering at the proper time of tide, a vessel drawing 8 feet can get through without stopping, as the tidal stream appears to separate about half way through, so that if a vessel entered with the flood at either end, and proceeded as the water rose over the shoal parts, maintaining a speed of 6 knots, the other end would be reached with the first of the ebb.

It is high water 50 minutes earlier at the western end of Bassein creek than at the eastern entrance. During the last quarter of the flood and first hour of the ebb, the stream runs westward throughout the creek, after which, however, the streams separate and flow out of both ends.

There are two other routes from seaward up Irrawaddy river, namely, that leading through Bassein river and Thamadine creek, and that through the entrance to the Irrawaddy proper, which enters the sea at a few miles westward of Krishna shoal. Of these routes, Thamadine creek, which is always used by the river steam vessels, is narrow and intricate, but has a depth of 3 fathoms; it joins the main stream at a little below Henzada, about 120 miles above Rangoon. The Irra-

Sketches of Irrawaddy river, 2135, 2136. Var. 0° 50′ E.

waddy proper is said to be the straightest and best channel to sea, having a depth of 12 feet on the bar at low-water springs.

Up-river pilots.—Pilots belonging to the Irrawaddy Flotilla Company have been found trustworthy; the frequent fluctuations of the river can only be followed by the constant observation of local pilots, who are each qualified for districts about 60 miles long. The pilots are mostly natives of Chittagong. Masters of Irrawaddy Flotilla Company pilot their vessels as far as Danubyu; thence to Bhamo, local pilots are employed.

Stream.—The average rate of the stream above tidal influence is 3 knots an hour, but at some points it attains a rate of 5 to 6 knots.

Rise of river.—The tide is felt as far up as Henzada, about 120 miles above Rangoon city. In March the river commences to rise, and it attains its maximum height in September, at which time it is, at Prome, about 34 feet above its dry season level. At Thayetmyo, after the first rise of the river in the early part of July, 1881, the water was 7 feet below the mean high level; it then fell 7 to 8 feet for 13 days, when it commenced to rise again. In 1877 the river is said to have risen 9 feet above the mean high level, the highest rise recorded. The rise varies, being sometimes greater at Prome than at Thayetmyo, 50 miles above; but generally it decreases below and increases above Prome.

At Thayetmyo the river is about 3 miles broad, and the bank, as a rule, so steep that vessels can lie sufficiently near to admit of hauling a boat to and fro by a line; care must be taken to keep clear of snags, which may project from the bank at a few feet below the water.

Up-river trade.—The Irrawaddy Flotilla Company with head-quarters at Rangoon, owning seventy-five steamers, eleven launches, and one hundred and fifty flats and barges, maintain the great bulk of the trade. The following are the stopping stations between Rangoon and Mandalay:—Yandun, Danubyu, Henzada, Yea-ghin, Myanaung, Prome, Thayetmyo (military station), Minhla, Magwe, Yenangyaung, Sinbyugyan, Nyaungu, Kuniwa, Pakokku, and Mandalay, about 350 miles above Prome.

The chief articles carried up-stream are piece-goods, rice, salts, hardware, and silk. The down-stream cargo consists of raw cotton, cutch (for dyeing), india-rubber, jade, spices, precious stones, timber, earth-oil, and cereals. The steamers stop on the downward voyage at Letsambu and Tsagine, in addition to the up-stream stopping stations.

Plan of entrance to China Bakír river on 833. Var. 0° 50′ E.

CHINA BAKÍR RIVER (*Lat. 16° 19′ N., Long. 96° 4′ E.*) flows into the sea through extensive flats of sand and mud, at about 4 miles south-westward of China Bakír lighthouse.

General charts 70, 748b.

Plan of entrance to China Bakír river on 833. Var. 0° 50′ E.

The coast is well wooded, and the entrance to the river can be made out from aloft by the long compact clump of dark trees on its eastern side, the western end of which appears very abrupt, as seen from seaward when abreast the entrance. Eastward of this clump the trees are much less compact with occasional large gaps

About half a mile westward of the western entrance point is a clump of cocoanut palms and 1¾ miles north-eastward of the eastern point is the town of Mengalon, with a ruined pagoda, not conspicuous, situated to the westward of it.

The western side of the entrance is wooded, but not so closely as the eastern, and there is a small clump of cocoanut trees near it, which may be useful for identification.

Both banks are lined with mangroves, and about 2½ miles from the eastern entrance point, or about 8 miles from the 3-fathoms contour line outside the shoals, the river forks: Bassein creek leading north-eastward into Rangoon river, about 10 miles below Rangoon city, and the other branch, which just inside the fork is partially blocked by an island and shoal water, having a westerly direction.

Anchorage (*Lat. 16° 13′ N., Long. 96° 14′ E.*) may be obtained in about 3¼ fathoms at low water, spring tides, with China Bakír lighthouse bearing about N.E. ¼ N., distant 5 miles; this position is about 2 miles from the narrows.

Directions.—Although the channel through the sand banks off the entrance to China Bakír river is very narrow at its outer end, a vessel of 15 feet draught can enter with care at high water, spring tides, but the entrance should not be attempted without the channel having been previously buoyed.

Within the narrows, the depth of water rapidly increases, and a N.W. by N. course, keeping on the eastern side of the river, leads to the fork.

If proceeding north-westward, the deep water channel is on the northern side of the island at the fork, and after passing close to the point at which the coast trends away north-eastward into Bassein creek, steer across the mouth of Bassein creek, keeping slightly eastward until the centre of the channel is open, when enter, avoiding the extensive mud bank which extends off the south-eastern end of the island, by keeping nearer to the northern shore. There is a small bank also off the northern point of the channel entrance, but of no great extent, and steep-to.

Charts 2135, 2136, 70.

Rangoon to Thayetmyo.—Route in dry season (about 15th October to 15th June).

From Rangoon to eastern entrance of Bassein creek, 13 miles.

General charts 70, 748b.

Charts 2135, 2136, 70. Var. 0° 50′ E.

From eastern entrance of Bassein creek to China Bakír river 27 miles.

From China Bakír to Thongwa, 46 miles, R. B.* Large village. Native supplies available.

From Thongwa (*Lat. 16° 38′ N., Long. 95° 46′ E.*) to Ma u bin, 7 miles, R. B. Fair-sized village. Native supplies available in limited quantities.

From Ma u bin to Danubyu, 44 miles, R. B. Large village. Native supplies available.

From Danubyu to Zalun, 28 miles, R. B. Native supplies available.

From Zalun to Henzada, 19 miles, R. B. Large town. Supplies available for both European and native troops.

From Henzada to Yea-ghin, 60 miles, R. B. Native supplies available.

From Yea-ghin to Myanaung, 14 miles, R. B. Native supplies available.

From Myanaung to Prome, 60 miles, L. B. Large town. Supplies available for both European and native troops.

From Prome to Thayetmyo, 44 miles, R. B. Large town. Supplies available for both European and native troops.

Total distance from Rangoon to Thayetmyo, 364 miles.

Note.—Time taken in above passage in river steamers with two heavy flats, 6 to 9 days. On emergency, with favourable weather and moonlight nights the passage could be done in 4 to 5 days. The down passage from Thayetmyo to Rangoon by the same route can be made in 3 days.

Sketch of Irrawaddy river, 2135.

Route in wet season (about 15th June to 15th October).

From Rangoon to Mayzali creek, 23 miles, *viâ* Hlaing or Rangoon river.

From Mayzali creek to Panhlaing creek, Kattywa, 13 miles, R. B. Fair-sized village. Native supplies available.

From Panhlaing creek, Kattywa to Irrawaddy river, Nyaundung, 24 miles, L. B. Large village. European and native supplies available in limited quantities.

From Irrawaddy river, Nyaundung, to Danubyu, 15 miles, R. B.

From Danubyu (*Lat. 17° 11′ N.*) to Zalun, 28 miles, R. B.

From Zalun to Henzada, 19 miles, R. B.

From Henzada (*Lat. 17° 41′ N.*) to Yea-ghin, 60 miles, R. B.

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* R.B. denotes right bank of river, L.B., left bank of river. Distances approximate only.

General chart 748b.

Sketches of Irrawaddy river, 2135, 2136. Var. 0° 50′ E.

From Yea-ghin (*Lat. 18° 10′ N.*) to Myanaung, 14 miles, R. B.

From Myanaung (*Lat. 18° 17′ N.*) to Prome, 60 miles, L. B.

From Prome (*Lat. 18° 49′ N.*) to Thayetmyo, 44 miles, R. B. (*See* remarks in dry reason route.)

Total distance from Rangoon to Thayetmyo, 305 miles.

NOTE.—Time taken in above passage in river steamers with two heavy flats, 5 to 8 days. On emergency, with favourable weather and moonlight nights, the passage could be done in about 4 days.

In the down passage from Thayetmyo to Rangoon the dry season route is adopted.

Chart 70, Bay of Bengal.

Upper Irrawaddy river.—The principal affluents of Irrawaddy river are the Mogaung, Ta-peng, Shwe-lí, Maina, Karen, Madava, Myitnge, Mu, Chindwin, Yaw, and Yen rivers; of these the Chindwin is by far the largest, and although not as deep as the Irrawaddy, drains a large area of country, and on meeting the main stream in about lat. 21° 45′ N., doubles its volume.

There are three defiles through which the Irrawaddy flows. The northern, above Bhamo town, is navigable by boats only in the dry season.

The second defile, 15 miles southward of Bhamo and very picturesque, is 8 miles long and about 160 yards wide at its narrowest part, the greatest depth being 23 fathoms; hills about 900 feet high rise almost perpendicularly on either hand.

The third defile, 35 miles above Mandalay, through which the river flows quietly between two ranges of mountains trending north and south, is 29 miles long, with an average depth of 4 fathoms, and a quarter of a mile wide at its narrowest part.

Sketch of the Irrawaddy river, 2136.

Thayetmyo (*Lat. 19° 35′ N., Long. 94° 55′ E.*) **to Minhla,** about 46 miles by river; the river runs northward for the first 25 miles of this distance (skirting the eastern face of a range of hills 1,200 feet high), when it is divided into two channels by Loungi island, wooded, 1½ miles in length, with a sand bank projecting from its northern and north-western sides; the channel, narrow but deep, lies along the western or right bank; care is necessary on account of the eddies that form off two small hillocks opposite the western point of Loungi island.

The eastern channel, which leads past the town of Senbaungwai, is only navigable in the wet season. There is no town of importance in this reach, Mye dai, 3 miles above Thayetmyo, being deserted.

From Loungi island to Minhla the river bends considerably, but there is no middle ground, and the course is an easy one, the river flowing between hills from 100 to 300 feet high, half way between Loungi island and Minhla.

Taung gwen island, 1½ miles long, with some ancient pagodas on it, lies in the centre of the river; the channel is on its western side.

Minhla (*Lat. 20° 1′ N., Long. 94° 47′ E.*) situated at an angle of the river on the right bank, had a population of 3,537 in 1901; Kola kone fort occupies the heights opposite the town. There is good anchorage where the river opens out between Kola kone fort and the town, except south-eastward of the point on which the town is built, where a sand bank exists. Vessels secure alongside the river bank close to a small square fort in the centre of the town; trade is considerable, and is probably brought down Yen river. The stream is rapid off Minhla.

Yen river joins the Irrawaddy on the left bank, 7 miles above Minhla, having off its mouth a large low island surrounded by sand banks, on the southern side of which is the channel.

Magwe, 15 miles above Minhla, is the head-quarters of the District of the same name, and consists of a group of villages collected round the civil station on the eastern bank, the chief feature, seen from the river, being Myathalun pagoda, built on a slight eminence; the town has one main street, stretching parallel to the bank, with minor thoroughfares.

The civil station contains the usual offices, with a jail, and barracks for police; in 1901 the population was 6,232.

Large sand banks in front of the town prevent river steamers from going alongside.

Hospital.—The civil hospital has 22 beds.

Minbu town, nearly opposite Magwe, is also conspicuous by its pagodas and high cliffs. The hills lie well back in this reach except at Magwe and Ta fau zeik, an abrupt rocky point with cliffs 80 to 120 feet high and a pagoda on their summit; the channel passes close to this point, a sand bank extending towards Ta fau zeik point from the opposite bank narrowing the channel considerably.

Yenangyaung, about 25 miles above Minhla, in 1901 had a population of 3,246; some petroleum wells are situated about 5 miles eastward of the town. From Minhla to Yenangyaung the river continues northward, and 2 miles above the former it opens out considerably, and central low-lying islets and sand banks make the channel intricate; it receives five tributaries, viz., on the left bank the Yen, the Karen 10 miles below, and the Pin one mile above Yenangyaung; and on the right bank, Ma river immediately above Minbu and a smaller stream opposite Yenangyaung. The stream is stronger in this reach than in any other above Thayetmyo.

The low central islands and the flats on either bank are covered with elephant grass 8 to 10 feet high; most of these islands cover in August, the grass only showing above the water. Temporary villages are built on piles, and the islands are cultivated during the dry season.

From Yenangyaung (*Lat. 20° 35′ N., Long. 94° 42′ E.*) **to Pagan,** a distance of 42 miles in the wet and 50 miles in the dry season, the river trends north-north-westward and northward. The most important places in this reach are Kyabin, near Sinbyugyun on the right bank, and Pagan nge and Silli myo on the left bank. The channel crosses the river about every 6 miles, and the breadth between the main banks averages 2 miles; the greatest width of river is between Pagan nge and Silli myo, nearly 4 miles between the main banks.

The bed of the river is filled with extensive flat islands that nearly cover in the freshets, and in the dry season the channel lies between the two large alluvial islands, the main banks being recognised only by the line of large trees showing on either hand; about 10 miles above Yenangyaung and again above Palaimyo, low hills run close down to the river bank

About 6 to 10 miles eastward of Silli myo, a solitary mountain named Paop pa doung, rises abruptly, and is visible from Magwe up to Myingyan. Some of the bends of the channel in this reach are very sharp, turning almost straight across the river; it is advisable to keep the up-stream side of the channel.

Yaw river, entering this reach 13 miles below Pagan on the right bank, is the only one of importance. It disembogues through a range of hills faced with abrupt cliffs, but in the dry season the entrance is barred by sand banks. Six miles below Pagan the crossings are very crooked.

From Pagan (*Lat. 21°11′ N., Long. 94°42′ E.*) **to Myingyan,** a distance of 30 miles in the wet, and 40 in the dry, season, the general trend of the river is north-eastward, and it seldom exceeds 3 miles in width between the main banks, which are low; a small range of hills, lying 3 miles back from the bank southward of Pagan, trends southward for 7 miles. Two conspicuous hills lie about 7 miles south-south-eastward of Myingyan, and are in line from 2 miles westward of the town.

Pagan village, known also as Old Pagan, is near the site of an ancient ruined capital of the Burmese empire, and the ruins of the walls and traces of the moat may be seen; there are innumerable pagodas in the vicinity, some containing stone sculpture of exquisite

Sketch of the Irrawaddy river, 2163. Var. 0° 50′ E.

workmanship, and interesting terra-cotta tiles. Both here and at Yenangyaung the soil is very remarkable, showing a process of fossilization, the fields and river banks being covered with specimens of fossilized trees.

In 1901 the population of Pagan village was 6,254.

Chart 70, Bay of Bengal. Var. 0° 50′ E.

Nyaungu (*Lat. 21° 12′ N., Long. 94° 50′ E.*), immediately above Pagan and on the same side of the river, is recognised by its cliffs, which rise abruptly from the river side to a height of about 100 feet, and are pierced with holes; this place is a calling station for the Irrawaddy Flotilla Company's steamers.

Kuniwa and Pakokku, the only villages of any size in this reach, lie on the right bank of the river. In the wet season steamers call at Pakokku, using the channel northward of the island opposite the village. In the dry season the channel lies southward of the island and continues along the southern bank. This bank, a little above Kuniwa, has a rocky foreshore with off-lying rocks, which make it very dangerous; the rocks are buoyed, and a European in the employ of the Irrawaddy Flotilla Company is responsible for the buoyage. The course after these rocks are passed is an ordinary one with two sharp turns before reaching Myingyan, 4 miles below which town is a 6-foot crossing.

Chindwin river, the largest tributary of the Irrawaddy, drains the country 90 miles westward of the right bank of that river, joining the main river 10 miles below Myingyan, some 6 miles above which town the Irrawaddy is connected with Chindwin river by two shallow channels navigable only by boats.

The Chindwin river is between 500 and 600 miles in length, and for more than 400 miles of its course it is navigable for steam vessels during certain seasons of the year, the Irrawaddy Flotilla Company's steamers running the whole year round as far as Kindat, 200 miles from its mouth, and during the rains as high as Homalin, about 130 miles further up stream.

Myingyan to Mandalay is a distance of 60 miles in the wet and 65 in the dry season, and the general trend of the river is northward for 22 miles toward Myinmu, then eastward 21 miles to Ava and from Ava north-north-eastward 10 miles to Mandalay. The river for the first 15 miles of this reach is narrow, but clear of shoals; the banks are hard, except the flat ground off the north end of Myningyan town.

Samaikkon is a pilot station on the left bank, a distance of 15 miles from Myingyan; above the village the river widens and the

General chart 748b.

Chart 70, Bay of Bengal. Var. 0° 50′ E.

banks become low, the deep channel ultimately following either bank for about 3 miles at a stretch.

Nazum is a pilot station about 24 miles above Samaikkon on the right bank, near the entrance of Mu river, the mouth of which is dry in January.

Ava (*Lat. 21° 50′ N., Long. 95° 59′ E.*), a picturesque former capital of Burma, is situated in an angle where the river turns from eastward to northward in the direction of Mandalay, the remains of the old city being built on a triangular island artificially formed by a channel between the Myitnge and the Irrawaddy; the few houses belonging to it are scattered about in more than two dozen hamlets, inhabited by lacquerers, weavers, and other artisans. The town of Ava lies on the left bank, and from the walls which rise up from the river bank, a rocky shoal stretches more than half way across the river towards Sagaing.

Sagaing town, the head-quarters of the District of that name, is picturesquely situated on the right bank, which is here high; it is embowered in tamarind trees, the civil station occupying the southern portion of the river front, while the native quarters lie to the south, north, and north-west of the European. In 1901 the population was 9,643.

The right bank has a large sandflat, projecting from the river, which slopes off towards the east, where vessels can go alongside the bank. A low range of hills, running north and south, and visible from Myin mu, terminates half a mile above Sagaing point; large iron-smelting works lie close to the southern extremity of the hills. Kaongniudhau, a large pagoda, with a nipple-shaped dome, conspicuous from the river, stands on the plain north-westward of Sagaing pagodas.

Vessels and barges filled with stones, were sunk opposite Ava, to prevent the British advance in 1885, but there is still a channel close to the sandflat of Sagaing and another close to the Ava shore. Possibly this dangerous portion of the river has been improved and buoyed.

Communication.—There is a steam ferry to Amarapura, and the railway station and steamer ghát are at the north-east corner of the town.

From Ava to Mandalay the channel runs between low-lying islets, and is intricate. Myitnge river, which enters the Irrawaddy at the north-eastern salient of the walls of Ava, is navigable for boats drawing 6 feet for over 5 miles; in January the bar at the mouth of the river had only 5 feet over it.

General chart 748b.

Chart 70, Bay of Bengal. Var. 0° 50′ E.

Mandalay, the capital of Upper Burma and the head-quarters of the Division and District of the same name, occupies a plain on the east bank of the river between it and the Shan range, the old city, known as Fort Dufferin, being 1½ miles from the river bank; its walls form a perfect square, the sides 1¼ miles long.

The palace (*Lat. 21° 59′ N., Long. 96° 5′ E.*) is in the centre of the square, with roads converging from each of the four main gates and bridges over a moat outside, and north and south of the palace are shady pleasure gardens with lakes and grottoes; round the palace are the throne room, the council chamber, and the bell and other towers, with many handsome pagodas in the vicinity.

The barracks and officers' quarters are within the fort walls, the Government house overlooks the moat from the north wall, and to the south, outside the walls, are the court houses, municipal office, and, further west, the hospital and railway station, while in the west is the business quarter of the city, with post and telegraph offices.

Population.—In 1901 the population was 183,816.

Communication.—Steamers of the Irrawaddy Flotilla Company run to Mandalay, which has also railway communication with Rangoon, *viâ* Toungoo, and lines extend north-west and north-east from it; the latter being in course of construction to Boduayn gold and silver mines.

Amarapura, the head-quarters of the subdivision of the same name, is situated on a strip of high ground between the Irrawaddy and Taungthaman lake, the old city, now covered by cultivation, being on the north side of the lake; it was the capital previous to its being changed to Mandalay. It is connected to its surroundings by a number of brick causeways and wooden bridges, has numerous pagodas in the vicinity, and abounds in tamarind trees and fine mango groves; in 1901, its population was 9,103.

Communication.—It is a station on the branch line which runs from Myohaung, on the Rangoon-Mandalay railway, to the river opposite Sagaing, and connected by ferry with the Myitkyina.

Trade.—The chief industries are silk and cotton spinning, weaving, and dyeing, and tobacco, beans, onions, ground nuts, and other crops are grown.

Mandalay to Kubwet, a distance of about 50 miles in the wet and 56 in the dry season; the general trend of the river is northward.

The first 38 miles, up to Singu, the only village of any size with the exception of Sheinmagar, is shallow and irregular, the right bank being straight with low hills nearly to the water's edge, and the left bank having flat islets projecting from it, behind which are numerous creeks and marshes.

In the wet season the right bank is usually followed up to the entrance of the third defile, which commences near Singu.

The Madava discharges into this reach on the left bank 16 miles northward of Mandalay, and forms a bar which carries on it only 6½ feet in the dry season.

A long stretch of shallow water, known as Henjazi bar, occurs 8 miles further northward, commencing a little above Sheinmagar; the crossings often have as little depth as 4 feet, and in the driest time of the year cargo and passengers have sometimes to be transhipped by boats; Ywathagi channel, to the westward, used in the wet season, has deeper water in it, but the rocks are said to be numerous, and in the dry season it is not used.

Two or three miles above Singu hills, covered with tall trees and thick bamboo undergrowth, commence, and form the third defile. In this defile the banks are steep and sometimes stony, while the centre is deep and clear.

Kubwet (*Lat. 22° 44′ N., Long. 95° 57′ E.*) is a pilot station, and lies nearly in the middle of the third defile on the right bank, about half a mile westward of where the river takes a sharp trend northward.

Kubwet to Myadaung is a distance of 70 miles, the general direction of the river being northward, continuing through the third or lower defile for about 9 miles to Sabenago, a large village on its right bank, here it widens out to nearly a mile between the main banks and resumes its deltaic character; hills from 400 to 500 feet run down close to the water's edge in this reach on the right bank.

The left bank is flat, though there is a range of mountains 4,000 to 6,000 feet high lying back about 6 miles, and following the trend of the river to about 20 miles southward of Myadaung. The channel is intricate, and there are two sharp crossings, one about 3 miles northward of Sabenago and the other about 12 miles further north.

Myadaung, a large village, is a calling port and pilot station for vessels of the Irrawaddy flotilla.

Myadaung to Modah is a distance of 45 miles, the general trend being north-north-eastward; the character of this reach is similar to the one below it. About 14 miles above Myadaung, on the left bank, is Shwelí or Nam Mao, a large river, which meets the Irrawaddy.

From Modah to 6 miles south-westward of it, the main banks are from 2½ to 2¼ miles apart; the islands that have formed in the bed

Chart 70, Bay of Bengal.

of the river narrow the channel to about a quarter of a mile in width, the channel lying alternately along each bank.

Modah is a pilot and calling station.

Chart 748b, Indian ocean, Northern portion. Var. 0° 50′ E.

Katha, situated on the right bank, the head-quarters of the District of the same name, about 200 miles above Mandalay, contains a bazaar and the usual public buildings, and is laid out along five principal roads stretching north and south, parallel to the river; in 1901 the population was 2,931.

Communication.—A branch line from the Sagaing-Myitkyina railway terminates here, and connects with the steam ferry to Bhamo and the steamers of the Irrawaddy Flotilla Company running between that station and Mandalay.

Modah to Bhamo, a distance of about 53 miles. From Modah the river trends a little northward of east for 10 miles, then southward past Shwégu through the pass of the second defile, where it again bends northward and then eastward for 10 miles, when it turns northward towards Bhamo.

The second defile begins a little above Shwégu, off which lies a large low island. About 4 miles from the above place is the pass, composed of a range of mountains from 800 to 2,000 feet high, through which the river flows, making a sharp bend through one of the valleys; the greatest depth found was 23 fathoms. The entire length of the defile is 6 miles, and the scenery is very fine, at one place the cliff rising perpendicularly 600 feet from the water.

In the freshets the eddies are so violent that it is with great difficulty steamers get through the pass, but in the dry season it is a quiet stream.

The character of this reach, with the exception of the defile, is the same as the others; the river is narrower, and navigable to within 1½ miles of Bhamo. The only place where there is any trade is at Sinkan, built at the mouth of a small creek, down which the Maungmahtaw timber rafts come to Shwégu and Kongti, both small villages; their inhabitants being Shans and a few Chinese.

Bhamo (*Lat. 24° 12′ N., Long. 96° 52′ E.*), the head-quarters of the District of the same name, extends along the left bank of the Irrawaddy for nearly 4 miles, the houses being ranged on two long roads parallel to the river, behind which is the maidan.

The Shan quarter is in the southern part, and on the southern edge of some higher ground extending eastward from the river are the hospital and the District postal and telegraph offices. The Chinese quarter and Burmese village are further north, the latter stretching to the military barracks; in 1901 the population was 10,734.

General charts 70, 748b.

Chart 748b, Indian ocean, Northern portion. Var. 0° 50′ E.

The town is not so subject to malarial fever as previously, owing to some of the backwaters having been drained.

A range of mountains similar to those near Mandalay lies some 10 or 15 miles eastward of the town, the plains coming close up to their bases. These hills are peopled by the Kachens, a small but vigorous tribe.

The chief exports from Bhamo are furs, rubies, raw silk. The principal imports are salt and cotton goods.

Sketches of the Irrawaddy river, 2135, 2136.

IRRAWADDY RIVER.—Banks, channels, &c.—The main banks of the Irrawaddy, generally distinguishable by high trees, pagodas, &c., are as a rule stationary, but the shapes of the flat alluvial islands and banks facing them are constantly being altered by the streams. The channel rarely keeps to the same bank for more than 3 miles, a small projection from the bank being sufficient to deflect the water towards the opposite side; obstructions under water often exist, and cause the crossing to assume an S shape; this is the most difficult form of crossing, for which no guide can be given.

Great experience is requisite in navigating the river.

The cutting away of the banks is one of the best guides for ascertaining the channel, for as the water impinges on the bank, it crumbles away and falls in; the point of greatest cutting is often indicated by flocks of crows and gulls, feeding upon the insects thus exposed, whilst, floating off into mid-channel, are drift and earthy bubbles.

The bubbles exist over any depth according to their size, from 2 feet diameter over 3 to 5 feet water, up to 8 feet over a depth of 2 to 3 fathoms. As a rule the deep water shows the fastest surface stream; the pilots, coming down the river, watch the play of light on the water to detect the curves that the rapid moving is taking, through the dead water of the shallows.

A vessel should keep to the up-stream sides of the crossings, so that in case of grounding she may swing off into deeper water.

Climate.—The cold season begins about the middle of November at Thayetmyo, the mornings and evenings being cool, the former sometimes foggy. From November to the middle of February the weather is fine and pleasant, especially between Mandalay and Bhamo. The nights are cold, and a strong breeze sets in about 1 a.m., that should be guarded against; often, as the wind drops, a thick fog comes on that lasts up to 10 to 11 a.m. The rainfall at Bhamo is reported to be heavy, and moderate at Mandalay, the lowest temperature observed on the 1st January at Bhamo was 52°; it has been known to fall there to 45°.

General charts 70, 748b.

Sketches of the Irrawaddy river, 2135, 2136. Var. 0° 50' E.

River levels.—The following observations show the difference of the river level in the wet and dry season at

Danubyu	on the 18th January	24 feet.
Henzada	„ 17th „	30 „
Thayetmyo	„ 16th „	35 „
Yenangyaung	„ 14th December	17 „
Estimated fall of the river at		
Pagan	on the 22nd November	14 feet.
Mandalay	„ 10th January	12 „
20 miles above Mandalay	„ 4th December	8 „
In third defile	„ 4th „	10 „
In second defile	„ 28th „	9 „

The river fell 8 feet at Pagan between the 24th November and 13th January; 6 feet at Thayetmyo between 2nd and 12th November. It is reported to fall a foot daily at the end of October.

Charts 823, Koronge island to White point; 830, Bay of Bengal.

GULF OF MARTABAN.—The Gulf of Martaban is nearly 125 miles in width between the south-east extreme of Pyapon island, on the west, and Ku-la-gauk island off the Amherst coast, on the east, and extends northward for a distance of about 90 miles to the shoals off the entrance to Sittang river.

The gulf is shallow throughout, the 10-fathoms contour line being nearly on that joining the two places above mentioned, inside which the water shoals gradually, the 5-fathoms contour line being roughly at half the distance to its head.

Anchorage.—There is anchorage anywhere in the Gulf of Martaban, where the depth of water will permit, but before anchoring the direction of the tidal stream should be ascertained, and very little cable be given until the vessel is head to it, when the necessary amount may be gradually veered.

SITTANG RIVER (*Lat. 17° 0' N., Long. 96° 48' E.*).—The coast eastward of the entrance to Rangoon river is low, and bordered by an extensive shallow bank of mud and sand, which prevents its being approached. Sittang river, at the head of the Gulf of Martaban, has a wide bell-shaped mouth; there is no chart of its channels, and it is only entered by local trading craft.

The Sittang river, sometimes named Paunglaung or Toungoo, rises eastward of Yamethin District, in about lat. 20° N., and, winding through Toungoo District, after a course of about 350 miles falls into the Gulf of Martaban.

It is connected at Myitkyo, a village on its lower reaches, with Pegu river by the Pegu-Sittang canal, and further southward, at

General charts 70, 748.

Charts 823, Koronge island to White point; 70, Bay of Bengal. Var. 0° 50′ E.

Mopalin, with Kyaikto and other portions of the Thaton District by the Sittang-Kyaikto canal, both canals primarily intended for navigation. Bridges are in course of construction at Toungoo and at the point where the railway to Moulmein crosses it.

Above Sittang town (*Lat. 17° 28′ N., Long. 96° 54′ E.*) the stream is so strong that this part of the river is scarcely navigable by the large native boats. During the rains communication with Moulmein (by boat) is kept up through Wengbadaw creek, the entrance to which is about 7 miles below Sittang town.

On the eastern side of Sittang river entrance are Zingyaik mountains, which are about 9 miles inland, and extend in a north-easterly and south-westerly direction, having several pagodas on their summits, the northern of which is the highest; these mountains are sometimes visible for a distance of upwards of 50 miles, but are of little aid to navigation, being too far inland.

Communication.—Toungoo is connected by railway with Rangoon and with Mandalay.

Tidal streams.—On the coast of Irrawaddy and Pegu the tidal streams have considerable velocity, the flood stream setting eastward, and the ebb westward when to the westward of Baragua flats; abreast of these flats and farther westward the rate of the tidal streams, especially the flood, is not so great as eastward of them.

From Baragua flats to Rangoon river entrance, the flood sets north-north-east and north-eastward, and the ebb south-westward. Between Rangoon river and Moulmein the flood sets into the Sittang river in a north-north-east and northerly direction on the Rangoon side, and north-north-westward on the Moulmein coast.

The general direction of the flood stream in the Gulf of Martaban is north-north-eastward, becoming more northerly as the eastern side is approached, and following the trend of the coast within a distance of 10 miles. The ebb stream in all parts of the gulf sets almost invariably in the reverse direction to the flood.

The rate of the streams is not much seaward of the 20-fathoms contour line; in that depth its rate is from 2 to 3 knots an hour at springs, which increases to 4 knots in latitude 16° N., and northward of this the streams are rapid running from 6 to 7 knots in latitude 16° 15′ N. During and immediately after the South-west monsoon, the ebb streams are much stronger and run longer than the flood.

The duration of slack water at springs is very short, not exceeding half an hour, and there is little difference in the direction of either stream at different times of tide in any part of the gulf.

General charts 830, 70.

Chart 823, Koronge island to White point. Var. 0° 50′ E.

A bore sweeps up Sittang river at spring tides; following it, and said to be as dangerous as the bore itself, is a chopping sea of sand and water. The Sittang has an enormous quantity of silt suspended in its water.

THATON DISTRICT.—From the eastern side of Sittang river entrance the coastline of Thaton district has a general south-east direction for nearly 60 miles to the west side of the entrance to Moulmein river. *See* Chapter I., page 51.

Plan of Moulmein river and approaches, 1845.

BILUGYUN ISLAND.—The coast eastward of the Sittang entrance is low, and trends south-south-eastward to the entrance of Martaban river, the northern mouth of the Salween, between which and Moulmein river, the southern mouth, lies Bilugyun island, 17½ miles in length in a north and south direction, and 8 miles in greatest width. A range of wooded hills, from 450 to 575 feet high, extends north and south throughout the northern half of the island; and there are several lower detached hills in the southern part of the island. The population in 1901 was 41,880.

Kwang la pagoda (Konla) (*Lat. 16° 14′ N., Long. 97° 33′ E.*), on the south-east side of the island, is situated on a hill 183 feet high, and, together with two others on the south coast of the island, form good marks in approaching Moulmein river. (*View on 1845.*)

The western coast of Bilugyun island requires a wide berth when approaching from northward, to clear the shallow water off it.

Charts 748b and 1693, Salween river.

MOULMEIN or SALWEEN RIVER rises in unexplored country to the eastward of Tibet, and flows from north to south, entering British territory at about the 24th parallel N. Thence bisects the Shan states and Karenni after passing the southern limit of the latter it forms the boundary between Siam and the Salween District, and then passes down the centre of Thaton District, and, after flowing for 650 miles through British territory, discharges into the Gulf of Martaban below the wooded heights of Moulmein.

Ten miles below its junction with the Taungyin, a tributary, are the great rapids, formed by a bridge of rocks extending completely across the river, which are impassable in the dry season, even by canoes. Ten miles further down the road there are less formidable rapids, but impassable in the rains, and below which the river is encumbered by numerous islands and shoals, which are covered in the rains, when the water rises about 30 feet.

Charts 1693, Salween river. Var. 0° 50′ E.

A few miles further southward it receives the waters of the Rwonzaleng from the westward, and hereabouts the hills on the left bank recede, those on the right diminish considerably in height, and the river traverses a more open and level country. Limestone rocks, rising suddenly out of the plain into serrated lofty ridges, appear on both banks at intervals.

At Moulmein the river receives from the eastward the Gyaing, formed by the junction of the Hlaingbwe and the Haungtharaw, and from the south-eastward by the Ataran. It here splits and enters the sea by two outlets, Martaban or Darebauk river, the northern of which, in about lat. 16° 30′ N., was the principal entrance, but is now filled with small islets and sand banks; and Moulmein river, the southern and navigable entrance. On its right bank, and opposite Moulmein town, is Martaban town.

Although, owing to its narrow rocky bed and frequent rapids, it is practically useless for the purposes of through navigation, it is greatly utilised for timber floating, and quantities of teak are sent down annually.

It is not bridged in British territory, but is crossed at intervals by ferries, the most important of which are Kun Long, Taw Kaw (Kaw ferry), Taw Maw ferry in Karenni, and ferries at Kyaukhnyat and Dagwin in Salveen District.

Plan 1845, Moulmein river and approaches.

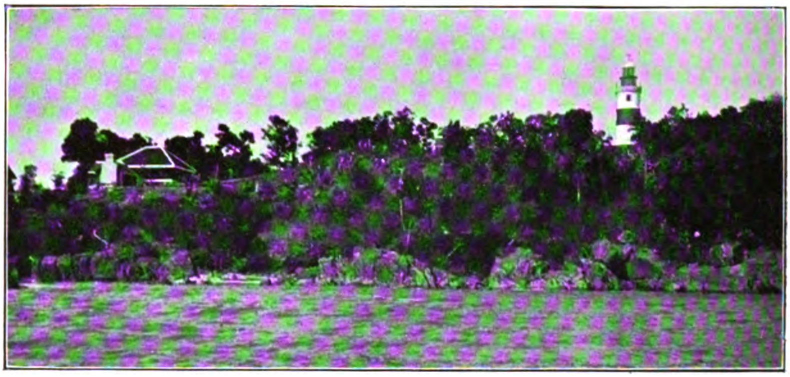
Tounzoun point (*Lat. 16° 14′ N., Long. 97° 32′ E.*), the south point of Bilugyun island, and the northern entrance point to Moulmein river, is the extremity of a ridge about half a mile in length in a north and south direction, and 170 feet high towards its northern end, lowering towards the point; there are several pagodas about the ridge, and Kwang la (Konla) pagoda, about 1¼ miles north-east of it, has been already mentioned as forming a good mark.

Amherst point, the southern entrance point to Moulmein river, terminates in a bluff point 60 feet high, the coast southward being low cliffs; on the extreme point is an old pagoda. A cable north-westward of Amherst point is the Water pagoda, a conspicuous building on piles surrounded by water at half tide, and on the rocky point, a mile to the southward, above the cliff, 40 feet high, is another pagoda which has a small pagoda close to it surrounded by water at high tide. (*View on 1845.*)

Signal and telegraph station.—A flagstaff is situated on Amherst point, and the signal station, which is the property of the Indian telegraph department, can signal messages or orders by means of the flags of the International code.

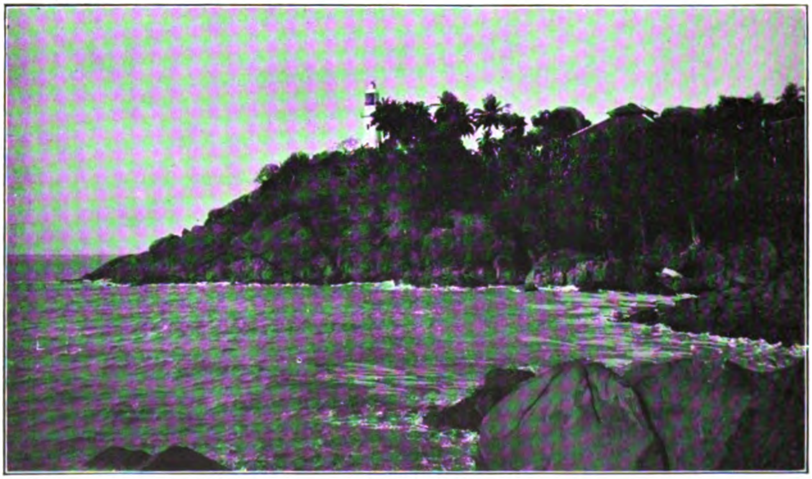
General charts 823, 830, 70.

(a)



Green island lighthouse from the southward.

(b)



Double island lighthouse from the southward.

Plan 1845, Moulmein river and approaches. Var. 0° 50′ E.

Green island (*Lat. 16° 4′ N., Long. 97° 33′ E.*), one mile south-south-west of Amherst point, is 145 feet high and covered with trees and brushwood, with a clump on its summit; it is surrounded by a bank with rocks and boulders on it, and it should not be approached within a distance of half a mile.

LIGHT.—On Green island, from a square tower of masonry, 65 feet in height, and painted red and white in bands, a *white flashing* light, with a period of system of *fifteen seconds*, is exhibited at an elevation of 135 feet above high water; it shows a flash, *three seconds*, followed by an eclipse of *twelve seconds* duration, and should be visible, in clear weather, from a distance of 17 miles. (View *a*, page 487.)

Tsheng Taung (Sendong), a wooded hill, 934 feet high, and 4¾ miles south-eastward of Amherst point, is conspicuous from the westward.

Entrance.—The entrance to the river, between Tounzoun and Amherst points, is 9 miles wide, but much encumbered by extensive sandbanks, which dry at low water, and some reefs. (*View on 1845.*)

Dangers.—The south-west side of Bilugyun island is fringed by a mud bank, which dries, with shoal water outside it, the whole extending to a distance of about three-quarters of a mile, but westward of Tounzoun point it is about 2¾ miles off-shore, and the south-west extreme of this shoal water is 3 miles south-west of the point, from which extreme the edge has an east-north-east direction, skirting the southern coast of the island at a distance of about 1½ miles, where immediately inside the edge of the shoal water is a bank of sand and mud, which dries in places from 10 to 12 feet.

Buoy.—A can buoy, painted black, and surmounted by a staff and cage, marks the south extreme of the shoal extending from Bilugyun island, and is the northern entrance buoy to New channel.

Bilugyun sands, occupying nearly the centre of the entrance between Tounzoun and Amherst points, is a large square-shaped bank, 2½ miles in extent, which dries from 6 to 10 feet in places; its sea face, lying in line with the coast, and in nearly a north and south direction, at the mouth of the river, is so steep-to that the lead gives no indication of approach to it.

It is separated from the shoal extending southward of Bilugyun island by New channel,and eastward of Bilugyun sands are a number of smaller patches, which dry, and almost completely fill the river to the east bank; their positions will be seen on the plan, but no navigable channel exists between them.

Buoys.—A conical buoy, painted red, and surmounted by a staff and cage, is moored a quarter of a mile off the north-west point of the

General charts 823, 830, 70.

shoal of Bilugyun sands, and is the southern entrance buoy of New channel.

A conical buoy, painted red, is moored about three-quarters of a mile west-north-west of the south-west extreme of Bilugyun sands.

Goodwin sands, two small, narrow patches, the southern of which dries 7 feet, lie about a mile south-eastward of Bilugyun sands.

Longstones reef.—From Amherst point a reef of rocky patches, with deep water between them, extends north-westward for a distance of 1¾ miles. The outer rocks of the reef cover when the tide has risen 9 feet above low-water mark, but the highest do not cover until the tide has risen 12 feet. The channels between the rocks should not be attempted, even by a boat, without local knowledge, except at slack water.

The Patch (*Lat. 16° 5′ N., Long. 97° 31′ E.*), on which there are general depths of from 9 to 16 feet, but less than 6 feet on a rock on its eastern edge, is 4 cables long in an east and west direction, and 2 cables north and south; its outer edge, with a depth of 11 feet, lies 2 miles west-north-west of Amherst point, and it is nearly joined by shoal water to Longstones reef.

Buoy.—A conical buoy, painted red and surmounted by a staff and cage, is moored in a depth of 70 feet 4 cables westward of the western extreme of the patch.

A shoal 1½ cables in extent, with 34 feet water over it, lies about half a mile south-westward of the buoy.

New channel.—The channels into Moulmein river are constantly altering, as, instead of the channel which is now between the south side of the shoal water and drying patches southward of Bilugyun island and the northern side of Bilugyun sands, the river was entered in 1877 southward of Bilugyun sands. The entrance between the extreme point of the shoal, 3 miles south-west of Tounzoun point, and that extending north-west of Bilugyun sands is half a mile wide, narrowing to about half a cable in parts of the river.

Depths.—The river is generally navigable from the sea to Moulmein for vessels of 25 feet draught at high water, spring tides, and of 18 feet draught at high water, neaps.

The depths in the channels to Moulmein vary considerably, and the bars are constantly shifting. The least depth of water on the various bars, from the last information, is, on Bilugyun crossing, 14 feet; Amelia crossing, 8 feet (1900); Sirrocca bar, 11 feet.

In consequence of the frequent changes and the rapid tidal streams setting in places across the channel, entrance into Moulmein river should not be attempted without a pilot.

Plan 1845, Moulmein river and approaches. Var. 0° 50′ E.

Pilots.—The pilot station is at Amherst point, and a pilot will be sent off on the pilot signal being made by day, or if a blue light is burnt at night, but entrance into the river is impracticable, except during daylight.

Tug.—A tug is available, but it is old, and of small horse-power.

Quarantine.—Vessels from an infected port, or having had sickness, or over two deaths on board during the voyage, or having plague on board, or those on board which plague has occurred within the preceding 12 days, should hoist a yellow flag, or at night three lights vertically, *red*, *white*, *red*, at the main, on arrival at the pilot station.

There must not be any communication between such vessels and the shore or any other vessel or boat, except to receive the pilot, his servant and baggage, until permission is granted in writing by the Health officer.

If there is a suspected case of plague on board or if more than two deaths from any cause have occurred during the voyage, the pilot anchors the vessel off North Beacon, below Lower Anchoring Creek, to await the Health officer; in other cases vessels are anchored at the north end of Mopun island. The segregation camp for plague is at Lower Anchoring Creek.

Outer anchorage.—The best anchorage and the most convenient position for pilots to board vessels at all seasons is in depths of from 9 to 10 fathoms, over mud, with Green island bearing N.E., distant $1\frac{2}{10}$ miles.

Off Amherst point and northward of the Patch buoy the bottom is foul, and the holding ground bad; the tidal streams are also very strong.

AMHERST (*Lat. 16° 5′ N., Long. 97° 33′ E.*).—Just inside Amherst point is the small village of Amherst, containing only a native population. It has a good circuit house, which is often visited by Europeans from Moulmein for sea air and bathing.

Anchorage.—There is a small snug anchorage inside Longstones reef and northward of Amherst point, but owing to the intricate channels through the reef, it is never visited by larger craft than those which can cross the flats eastward of Bilugyun sands.

Communication.—There is a mail service by steam launch three times a week between Amherst and Moulmein, and a post and telegraph office on the point, in connection with Moulmein, distant 56 miles, by a good carriage road.

General charts 823, 830, 70.

Chart 823, Koronge island to White point. Var. 0° 50′ E.

DIRECTIONS.—Bay of Bengal to Moulmein.—After passing Alguada light, steer to make Baragua flats and Krishna light-vessels; and from a position with Krishna light-vessel bearing North, distant about 8 miles, the depth then being from 14 to 16 fathoms, shape a course, about E. by N. ⅛ N., for Double island lighthouse, distant 110 miles, and having approached Double island to about 3 miles, steer about North for Amherst point.

In thick weather, during the South-west monsoon, should the position of the vessel be doubtful, keep well to the southward, and make the land a little southward of Ku-la-gauk island. With bad weather, particularly at or near spring tides, do not proceed to the anchorage off Amherst, but pass inside Ku-la-gauk island, and anchor in Bentinck sound (*see* page 499).

In clear weather, and often on a bright moonlight night, the high mountains in the interior, eastward of Double island, may be sighted before the lighthouse or light.

As the land near the river is seldom seen at a greater distance than half a mile during March, the land must be made well to the southward, and the position off Double island ascertained before steering for the river.

Vessels frequently get on shore at Bilugyun sands in fogs, in consequence of keeping too far to the northward; the lead gives no warning of approach to the banks, which are steep-to.

Charts 1845, 823.

Having made Double island (*Lat. 15° 52′ N., Long. 97° 37′ E.*) or its light, steer to pass a convenient distance outside it, and Green island lighthouse, or light, should be sighted before the vessel is abreast of Double island. Do not bring Double island lighthouse, or light, to bear southward of S.S.E. ½ E. until Green island lighthouse or light bears N.E., when steer for it, crossing the obscured arc of Double island light, and when that light is again visible, or the lighthouse bears S. by E. ½ E., anchor in from 9 to 10 fathoms water, as directed, page 489.

Caution.—When standing to the northward the position of the vessel must be constantly checked by bearings of Double island light, to prevent being set in towards the land, observing that the light is obscured southward of the bearing of S. 26° E., until close to the dangers in the entrance to the river.

In the event of the light-keepers at Double island requiring assistance they have instructions to darken the light for a short interval when a steamer is sighted, and as fever is prevalent on the island, this happens occasionally, and should be reported.

General charts 830, 70.

Chart 823, Koronge island to White point. Var. 0° 50' E.

Rangoon to Moulmein.—In shaping course allow for the tidal streams; great attention must be paid to the lead, and the soundings considered with the chart. In fine clear weather, the lofty, sharp, conical peak of Zingyaik mountains, the high land of Bilugyun island, and Tsheng Taung may be seen on approaching the river. In thick weather, especially in February, March, and April, as Bilugyun sands are steep-to and soundings give no indication of their vicinity, it is advisable to make the land between Button island and Pulo Krapo.

A good look-out must be kept and caution used in approaching the land, as soundings give no indication, and rocks and shoals extend three-quarters of a mile off the coast. The local steamers plying between Rangoon and Moulmein make Bilugyun island, but they are of light draught and high speed.

Plan 1845, Moulmein river and approaches.

Tides.—It is high water, full and change, at Amherst at 2h. 21m., springs rise 20 feet, neaps 13 feet; at the New channel at 2h. 41m., springs rise 22 feet, neaps 13 feet; at Anchoring creek at 3h. 1m., springs rise 18 feet, neaps 11 feet; at Natmu at 3h. 21m., springs rise 17 feet, neaps 10 feet; and at Moulmein at 3h. 41m., springs rise 14 feet, neaps 7 feet, and neaps range 6 feet.

The tidal rise above given is approximate only; very complete and reliable tidal data is given in Tide Tables for Indian Ports, published by the government of India.

Tidal streams (*Lat. 16° 4' N., Long. 97° 40' E.*).—In the offing at Amherst the flood or north-going stream commences about half an hour after low water at Amherst point, and the ebb or south-going stream about half an hour after high water there; the streams run 3¾ knots at springs, and about 2 knots at neaps, and there is very little slack water.

Outside Moulmein river entrance the flood stream sets northward along the coast, the ebb from about west-south-west at the second, to south at the fourth hour; and the rate of the stream, augmented on the ebb by the water from Sittang and Salween rivers, is very great. Off the entrance to Moulmein river the flood stream sets towards Longstones reef; and when the outer banks are covered, it sets strongly eastward over the sands. The streams within take various directions through the numerous channels between the banks.

In the river during the dry season the greatest rate of the stream is about 3 knots an hour, but in the wet season its rate is much greater, and in August the river is much swollen by rains, the tide rising 26 to 28 feet, and the stream attaining a rate of 7 knots an hour.

General charts 823, 830, 70.

Plan 1845, Moulmein river and approaches. Var. 0° 50′ E.

The streams turn approximately during the dry season as follows:—

Off Green island, flood stream begins at low water at Amherst; ebb stream, half an hour after high water at Amherst.

Off New channel entrance, flood stream begins 1h. 40m. after low water at Amherst, ebb stream 1h. 30m. after high water at Amherst.

At Lower Anchoring creek, flood stream begins 2h. 20m. after low water at Amherst, ebb stream 1h. 30m. after high water at Amherst.

At Natmu, flood stream begins 3h. 10m. after low water at Amherst; ebb stream 1h. 40m. after high water at Amherst.

Off Moulmein, flood stream begins 3h. 30m. after low water at Amherst; ebb stream 1h. 50m. after high water at Amherst.

The local authorities state that the durations of the flood and ebb streams are the same all the year round at Amherst, but at Moulmein their duration is approximately: October to January, 4 hours flood, 8 hours ebb; February to May, 5 hours flood, 7 hours ebb; June, 3 hours flood, 9 hours ebb; July to September, no flood except at height of springs.

See also the tidal diagrams on chart 823.

MOULMEIN RIVER.—Buoyage.—The channel of the river is marked by red buoys on the starboard hand, and black buoys on the port hand, entering, the two outer buoys having a staff and cage, and the only directions that can be given are to pass between the buoys.

Bilugyun crossing (*Lat. 16° 13′ N., Long. 97° 37′ E.*) had 14 feet least water over it, and is the narrowest and sharpest crossing in the river, the tidal streams setting strongly across it. It is reported to be narrowing, shoaling, and gradually edging further southward.

Amelia crossing had a depth of about 12 feet, and the tidal streams set obliquely across it; it was reported (1900) to have shoaled to 8 feet; both these crossings are buoyed.

Middle ground, westward of the northern part of Mopun island, has a depth of 9 feet over it.

Buoy.—Middle ground is marked by a conical buoy, painted black and white in horizontal stripes, which can be passed on either side.

Plan 1646, Moulmein harbour.

Sirrocca bar, the depths on which are constantly changing, had 11 feet water on it in 1899, and 14 feet in 1900. The Port office flagstaff in line with the eastern fall of the Duke of York's Nose, a remarkable hill northward of Moulmein, bearing N. 7° E., leads over the bar in the deepest water. (*View on 1646.*)

Sirrocca rock, with less than 6 feet water on it, lies nearly in the centre of the river north of Sirrocca bar.

Plans 1646, Moulmein harbour; 1845, Moulmein river. Var. 0° 50′ E.

Buoy.—A conical buoy, painted black and white in horizontal stripes, is moored in a depth of 14 feet 100 yards south-westward of the rock.

Anchorages.—There are anchorages in the river at the following places, but vessels must moor, as in no case can they lie at single anchor.

North beacon anchorage.—North beacon is situated on the east bank, nearly 2½ miles eastward of the south point of Long island, and there is good anchorage in from 20 to 30 feet water, clear of the fairway off the beacon, and between it and the tide gauge. This is the quarantine anchorage.

Natmu is on a point of the west bank about 1¾ miles northward of the north end of Long island, and good anchorage may be obtained in from 25 to 35 feet, three-quarters of a mile southward of Natmu.

Mopun (*Lat. 16° 25′ N., Long. 97° 36′ E.*).—The deepest anchorage in the river extends from the northern end of Mopun island to Sirrocca bar; at its southern end the depths are about 35 feet, and at the northern end 8 to 10 fathoms, the anchorage being about a third of a mile westward of Mopun pagoda, which is a good berth for large steamers wishing to avoid crossing Sirrocca bar.

Moulmein anchorage, off the town in depths of from 30 to 40 feet, is more roomy than Mopun anchorage.

Directions.—The channel, entered between the south point of the shoal extending 3 miles south-west of Tounzoun point and the north-west extreme of Bilugyun sands, takes an east-north-easterly direction, passing 1¾ miles southward of Bilugyun island and 2¼ miles southward of Long island; it then bends to the south-eastward for about a mile to Bilugyun crossing, when it turns sharply northward, requiring care in large vessels.

From Bilugyun crossing the channel follows the east bank until a mile above Half-way creek, where it turns west-north-west over Amelia crossing, and passes along the east coast of Long island for a short distance, then follows almost mid-channel of the river to the south point of Mopun island, taking along the east side of that island until about half a mile south-west of its north point, when its course is along the western bank to New island, from which it crosses Sirrocca bar to the anchorage off Moulmein.

Owing to the great changes invariably occurring, after every monsoon, both in the banks and in the river bed, implicit reliance should not be placed on the plan of the river and its approaches.

General charts 823, 830, 70.

Plan 1646, Moulmein harbour. Var. 0° 50′ E.

Port of Moulmein.—The port of Moulmein commences at about 24 miles from the entrance to the river, after Sirrocca bar has been passed, and extends for a distance of about 2½ miles to Battery point, northward of the town, with breadths of from 2 to 4 cables. The port is in charge of a Port officer belonging to the Royal Indian Marine. (*View on 1646.*)

Dangers.—Wales, Castle, and Town rocks, the first two on the eastern and the last on the western side, have less than 6 feet water over them, and are outlying dangers in the port.

Buoys.—A conical buoy, painted red, is moored at a distance of nearly a cable south-south-west and north-west, respectively, of Wales and Castle rocks, and the north-east side of Town rock is marked by a conical buoy, painted black.

Wharves (*Lat. 16° 29′ N., Long. 97° 37′ E.*).—There are six pontoon wharves or jetties, the four northern being Rangoon, Main, Cohen's wharves, and Kaladan jetty. Mission Street jetty has 16 feet alongside it at low-water springs, and Main wharf 11½ feet, the latter being used by the steamers plying to Rangoon.

Storm and weather signals.—The usual storm signals for India, and weather signals for the Bay of Bengal, are exhibited from the Port office flagstaff. *See* pages 74-76.

General signals.—The following signals are made at the Port office and Hill flagstaves:—British vessel of war, white ensign.

Foreign vessel of war, blue flag, yellow border.

Indian government vessel, blue ensign.

Transport with troops, red ensign.

A steamer, blue flag, with white cross.

B. I. S. N. Co.'s steamer from Calcutta and Rangoon, blue pendant.

B. I. S. N. Co.'s steamer from Singapore, rendezvous flag.

Coasting steamer from southward, red, yellow, blue, horizontal, pendant.

Tapoy and Mergui mail, white pendant with red ball.

B. I. S. N. Co's steamers (other than above), white flag with red cross.

Asiatic Co.'s steamer, blue, white, blue, horizontal, flag with blue star in centre.

Sailing ship or barque, ball at yard arm.

Brig, schooner, or native craft, triangle at yard arm.

A ball below the signal indicates European mail by whatever steamer it may come.

A gun is fired by the steamer with English mails when passing Mopun point.

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Plan 1646, Moulmein harbour. Var. 0° 50′ E.

Time signal.—A gun is fired daily (Sundays excepted) at noon, Burma standard time, but it is only approximately correct and must not be used for rating chronometers.

MOULMEIN (*Lat. 16° 29′ N., Long. 97° 37′ E.*), the headquarters of the Amherst District is situated amongst beautiful scenery on the left bank of the river, 25 miles from the sea, and occupies an area of 15 square miles, stretching long and narrow along the bank of the river, and being laid out in a fairly regular plan.

The most notable buildings are the Commissioner's house, the law courts and Government offices, the General hospital, the Government schools, and St. Matthew's, St. Patrick's, and St. Augustine's churches; the European residences, generally in spacious and well-kept grounds, are on the western side of a central ridge. In 1901 the population was 58,446.

The Port, Custom, and Telegraph offices are on the bank of the river, which is bunded, and there are good landing piers.

Communication.—There is steam communication with Rangoon three times a week, the local steamers employed making the passage in 9 hours; with Calcutta, Madras, Colombo, Bombay, touching at all important ports, by B. I. S. N. Co.'s steamers weekly, this line having a fortnightly service to Yé Tavoy river, Mergui, and Penang; also to Calcutta direct, and *viâ* Rangoon, by steamers of the A. S. N. Co. Coasting steamers connect with the southern provincial ports of Tavoy and Mergui fortnightly, and the inland waters are served by steamers of the Irrawaddy Flotilla Company. A weekly steam service is maintained to Penang and Singapore. Moulmein is connected with the universal telegraphic system, but it has no railway communication.

Coal and supplies.—About 400 tons of coal are kept in stock, and about 800 tons imported annually; coaling is carried on by bags, and there is a large number of lighters holding from 13 to 180 tons. About 75 tons could be put on board in 24 hours; there is also a coal wharf 56 feet in length, with a depth of 6 feet alongside.

Supplies of fresh meat, vegetables, and bread may be obtained, and drinking water is brought in tank boats; the water is brought from a reservoir, situated 4 miles southward of the town.

Caution.—Deaths from cholera have occurred from drinking the river water; although quite fresh it should not be used.

Repairs.—Small repairs can be executed at Moulmein, and coppersmith's work done; a travelling crane will lift 5 tons.

Hospital.—There is a good hospital at Moulmein, with accommodation for 50 European seamen and 9 officers.

General charts 3481, 823, 830, 70.

Chart 1646, Moulmein harbour. Var. 0° 50′ E.

Trade.—The chief exports are husked rice, teak, and rice-bran, and the imports betel nuts, sugar, and provisions of various kinds. The principal native industries are gold and silver work and ivory carving, and there are fourteen steam saw mills, three rice mills, besides a steam joinery and a foundry. Teak, valued at £81,642, was floated down the Salween river to Moulmein in 1908.

Winds and weather.—In December the wind is chiefly from north-east to east, light, sometimes shifting to the north, and even north-west; the weather fine and clear.

In January the wind continues light from the same quarter, but in the early part of the month the mornings and evenings are misty, though the weather is fine; towards the end of January the wind veers south-eastward, and the weather becomes foggy.

In February light land and sea breezes set in, the land breeze being from east and north-east, the sea breeze from west and north-west.

In March the land and sea breezes continue, the land breeze being from south-eastward and the sea breeze from south-westward, the former light, but the latter sets in with strength, and blows fresh at Amherst between 2 p.m. and 4 p.m., after which it dies away.

From July to September the weather is very stormy.

Fogs.—The weather is fine in February and March, but fogs become frequent and thick towards the end of the former and throughout the latter month. They are thick, and last for three or four days at a time, obscuring even the banks of the river, and rendering its navigation difficult; this being further increased by the natives lighting large fires to burn the paddy husk and straw, causing dense smoke and adding to the thickness of the weather.

AMHERST DISTRICT.—From Amherst the coastline of Amherst district extends in a south-south-east direction for about 55 miles to the entrance to Yé river. *See* Chapter I., page 53.

Chart 3481, Moulmein river to Yé river.

COAST.—From Amherst point the coast, trending in a southerly direction for 4½ miles to abreast of Button island, then turns south-eastward for 4 miles to abreast of Pulo Krapo, and is rocky, indented, and has occasional cliffs; Tsheng Taung, 934 feet high, a very conspicuous hill 2½ miles east-north-east of Button island, has been already mentioned.

From Pulo Krapo (*Lat. 15° 57′ N., Long. 97° 37′ E.*), where there is a pagoda 70 feet high, the coast has a south-east direction for 5¾ miles, and then turns to the southward for about 8 miles to Bluff point, forming a bight; a point, surmounted by a hill 310 feet high, *Chart 3481, Moulmein river to Yé river. Var. 0° 50′ E.*

projecting from the coast at 3½ miles from Pulo Krapo, is conspicuous, but the rest of the coast is low and densely covered with jungle to the water's edge.

Sand flats, covered with mud near the beach, uncover for a distance of 1¾ miles from the shore near the centre of the bight, and there are entrances to several creeks; at 1¼ miles northward of Bluff point is a pagoda, situated on a small reef connected to the shore.

In the bight between Pulo Krapo and Bluff point mud flats extend about 1½ miles from the coast for a distance of 7 miles northward of the latter, and the 5-fathoms contour line crosses the bight at a distance of about 3 miles from the coast of the centre of the bight.

Double island (*Lat. 15° 52′ N., Long. 97° 35′ E.*), 12½ miles southward of Amherst point, and nearly 5 miles off-shore, has trees on it which rise to the same height as the top of the lighthouse; it is steep-to on its western side, but rocky ledges, with depths of from 2½ to 4½ fathoms over them, extend for a distance of half a mile south-south-east and 1½ cables eastward and also northward of the island. The channel between the island and the mainland is clear of danger.

LIGHT.—On the north point of Double island, a masonry tower, 75 feet high, painted white, exhibits at an elevation of 120 feet above high water, a *white fixed* light, which should be visible, in clear weather, from a distance of 17 miles. For limits of visibility, *see* chart and Light list. (View *b*, page 487.)

Landing on Double island is difficult in bad weather; the landing place is close to a crane on the eastern side of the island.

Caution.—Shoaler water than charted having been reported to exist off Double island, this locality should be navigated with care.

Tides.—It is high water, full and change, at Double island at 2h. 5m.; springs rise 18½ feet, neaps 12 feet; neaps range 7½ feet.

Tidal streams.—The tidal streams in the vicinity are strong, running 4½ knots at springs and about 2 knots at neaps, the flood setting northward, and the ebb southward. The streams turn about half an hour after high and low water at Amherst point; there is very little slack water.

Plan 3518, Bentinck sound.

North rocks are two detached groups, 1⅓ miles apart in a north-north-east and south-south-west direction. The northern group covers at high water, spring tides, and the highest of the southern group is 20 feet high, and situated nearly 7¼ miles south-south-east of Double island.

General charts 823, 830, 70.

Plan 3518, Bentinck sound. Var. 0° 50′ E.

Patches of 4½ and 4¾ fathoms lie between the northern group and the 5-fathoms contour line of the coast, and vessels should not pass between North rocks and the mainland.

COAST.—From Bluff point to Pagoda point the coast, trending for a distance of 8½ miles in a southerly direction, has thick jungle growing to the water's edge, and between these two points are the entrances to Hteng-yu and Anin creeks, which dry at low water; the coast is generally sandy, with a few rocky points fronted by mud and sand flats, with occasional rocky patches.

Evans ridge, a low range of coast hills, from 300 to 420 feet high, commences about 3½ miles south-south-eastward of Bluff point, and from that curves to the south-eastward for 2 miles.

From Pagoda point the coast trends south-south-eastward for 5½ miles, and then turns south-south-westward for 3 miles to Bentinck point, off which reefs extend for 1¼ miles in a north-west direction; Thebeye and Thanze (Dermonjai) creeks enter the sound in this stretch of coast, which latter is covered with jungle, except for two conspicuous coast hills.

Keokpadang pagoda, 4⅝ miles southward of Pagoda point, and off the entrance to Thanze creek, stands on a reef, half a mile in length in a north-north-east and opposite direction, and 3 cables in breadth, which is connected to the shore by a sand flat, drying at low water, spring tides.

KU-LA-GAUK ISLAND (*Lat. 15° 35′ N., Long. 97° 40′ E.*). —**Portland point,** the north point of Ku-la-gauk island, is 17 miles southward of Double island; Ku-la-gauk island affords a good landfall during the South-west monsoon for vessels bound to Moulmein. The island is 5½ miles in length in a north and south direction, or parallel with the coast, and nearly one mile in greatest width, and is formed of several hummocks, Woodstock hill, the summit and northernmost, being 600 feet high.

The coasts are much indented and formed chiefly by cliffs, with some small sandy bays and mangrove swamps between them, and the shores are steep-to all round, the 5-fathoms contour line being nowhere more than half a mile off.

A quarter of a mile southward of the southern point is Cavendish islet, 320 feet high, with rocks extending from its north-east and south-west sides, the former awash at high water, spring tides, and the latter drying 11 feet; shoal water extends 4 cables southward of the islet.

The Peepers, two small rocks, 2 feet high, are two cables off the west coast of Ku-la-gauk island at nearly a mile north-north-west of its south point.

General charts 3481, 823, 830, 70.

Plan 3518, Bentinck sound. Var. 0° 50′ E.

Lights.—Two *white fixed* leading lights, 42 and 68 feet in height, respectively, and in line bearing S. 36° E., are exhibited from the north point of Ku-la-gauk island, for the use of small vessels passing between it and Galloper sand.

Galloper sand, extending in a northerly direction for 6½ miles from Portland point, the north extreme of Ku-la-gauk island, is about a mile in width at its southern part, tapering to its extreme, and dries in patches at low water.

Pulo Kropik (Tree island), about 2 cables in extent and 180 feet high, is situated about three-quarters of a mile off the mainland, and nearly 2 miles eastward of the north extreme of Galloper sand. A shoal with a depth of 2½ fathoms over it lies 6 cables westward of the north point of Pulo Kropik.

South shoal, the north extreme of which is separated from the shoal extending from Cavendish island by a channel a third of a mile in breadth, with depths of from 6½ to 8 fathoms, extends in a southerly direction for a distance of 2 miles, with a greatest breadth of half a mile, within the 5-fathoms contour line; it has a least depth of 4 fathoms over it.

BENTINCK SOUND, between Ku-la-gauk island and Galloper sand on the western, and the mainland on the eastern, side, affords secure anchorage, especially during the South-west monsoon, in depths of from 6 to 8 fathoms over a space 8 miles in length and 3½ miles in width.

Entrances.—The northern entrance to Bentinck sound, between the 5-fathoms contour line of the north extreme of Galloper sand, and that of the shoal water extending from the mainland northward of Pulo Kropik, is nearly a mile in width. The southern entrance between Cavendish islet and Bentinck point is 3¼ miles in width between the 5-fathoms contour lines.

Depths.—The depths in both entrances are from 6½ to 8 fathoms.

Anchorage.—The best berth is in from 6 to 7 fathoms water, about half a mile off Steep point, a point about the middle of the eastern side of Ku-la-gauk island.

Middle ground (*Lat. 15° 38′ N., Long. 97° 42′ E.*), with a least depth of 4½ fathoms, over muddy bottom, is 1¼ miles in length in a north-north-west and opposite direction and about 2 cables in greatest breadth; its south extreme is nearly 2 miles westward of Pagoda point.

Directions.—Northern entrance.—The south extreme of Pulo Kropik, in line with Symms hill, 1,290 feet high, isolated, conspicuous, and situated 6 miles eastward of Pagoda point, bearing S. 51° E., leads midway between the north extreme of Galloper sand and the shoal water extending from the coast, northward of Pulo Kropik, and when the northern summit of Evans range bears E. by N. steer South to pass between Galloper sand and Middle ground, taking

General charts 3481, 823, 830, 70.

Plan 3518, Bentinck sound. Var. 0° 50′ E.

care to avoid being set by flood stream towards the former, or by the ebb towards the latter.

Without local knowledge this entrance should not be used in a vessel of deep draught, as no leading marks can be given after passing the northern end of the Galloper sand, and the tidal streams set very strongly and obliquely across the channel.

Southern entrance.—Entering from the southward, Sharp hill should not be brought to bear southward of E. ½ N., until the east side of Ku-la-gauk island is open of the eastern extreme of Cavendish islet, bearing N. 4° E., when alter course to pass one mile eastward of that island.

Tides.—It is high water, full and change, in Bentinck sound at 0h. 41m.; springs rise 18½ feet; neaps rise 12 feet.

Tidal streams.—The tidal streams run through the channel, forming the northern entrance, with a velocity of 5 knots; both flood and ebb set towards Galloper sand, the former when inside, and the latter when outside, or westward of it.

The rates of the tidal streams in Bentinck sound are from 2 to 3 knots.

Water.—A small quantity of water may be obtained from a spring close to Pulpit rock, on Ku-la-gauk island.

Chart 3481, Moulmein river to Yé river.

COAST.—From Bentinck point the coast trends in a south-south-east direction, for a distance of 5½ miles, and then south-west for about the same distance, curving round Hope point, which is rocky and surmounted by a small hill, 360 feet high; sand and mud flats front the shore, drying out to a distance of 1¼ miles. From Hope point the coast has a southerly direction, is cliffy, much indented, and with densely-wooded hills close behind it; of these, Phalein hill, 1,710 feet high, and situated 4 miles south-south-east of Hope point, is very conspicuous.

Aye island (*Lat. 15° 18′ N., Long. 97° 43′ E.*), 1¼ miles off-shore, 3 miles south-south-west of Hope point, is 8 cables long in a north-west and south-east direction, 3 cables broad, and 460 feet high; it is densely wooded, and has rocky shores, difficult to approach.

A shoal of which a considerable part dries at low water, spring tides, extends first in a northerly direction from Aye island, and then curves to the north-north-eastward, its northern extreme being about half a mile north-west of Hope point; shoal water also extends about 6 cables southward of the island.

Chart 1272, Approaches to Yé river.

YÉ RIVER.—Approach.—The high land, of which Phalein is the summit, extends to the south-westward to 4½ miles northward of the mouth of Yé river, and the steep and rocky coast, thickly wooded, after a small creek is passed, changes to a sandy beach, fringed with jungle, which extends for 3¼ miles to Pagoda point.

Pagoda point, a conspicuous hillock, 151 feet high, rising abruptly from the beach, and surmounted by a small pagoda, forms the northern, and Sidawtaung, a bold headland, 577 feet high, which from the westward and north-westward appears flat-topped, but from southward conical, the southern entrance point to Yé river. (*View on 1272.*)

The coast southward of Sidawtaung for a distance of 9 miles is low and sandy with occasional small headlands, but the high ranges at the back give it the appearance of being steep.

Toby rock (*Lat. 15° 16′ N., Long. 97° 43′ E.*), about 2 miles south-south-east of Aye island, and 6 cables off shore, nearly covers at high water, and is situated on a ridge with depths of 3½ fathoms over, and from 6 to 7 fathoms round, it.

Stag island (Wa Gyun), the northern of the islands lying off the mouth of the river, is one mile long in a north and south direction, and has two summits, the northern and higher being 444 feet high. Its western side is steep, but on its eastern side there is a beach, where fresh water can be obtained. (*View on 1272.*)

A spit, with depths under 3 fathoms, extends 8½ cables north-north-west of the north end of the island, and a similar spit projects about half a mile in a south-east direction from the south end.

Outer (Nat Gyun) island, the trees on which are 153 feet high, is about 9 cables south-west of Stag island, and has rocks, awash at high water, spring tides, lying 2 cables north-west of its north point, with shoal water to the 5-fathoms contour line, extending nearly one mile northward of them.

Bath Bun (Nya Pya Gyun) island, 444 feet high, and about half a mile south-eastward of Outer island, is 6 cables long in an east and west direction, and is on the northern end of a ridge of hard sand, nearly 3¾ miles long in a north and south direction, which dries from 3 to 4 feet; a detached bank, which dries from 2 to 5 feet, lies northward of Bath Bun island, and, with the shoal extending from Outer island, forms the south-west side of the channel separating these from Stag island, which channel, although having depths of from 7 to 11 fathoms, is not recommended to be used.

Ghorparay rock, 3 cables south-westward of the westward extreme of Bath Bun island, dries about 3 feet.

From the 3-fathoms contour line at the north end of these islands, the narrow ridge extends, with depths under that, continuously for

Chart 1272, Approaches to Yé river. Var. 0° 50′ E.

a distance of 12½ miles in a southerly direction, and at one mile westward of its northern part are depths of from 7 to 8 fathoms, even bottom, sand and mud, while further south, at the same distance, they increase to 10 fathoms.

Kyetiki Gyun, a low wooded islet, the tops of the trees being 78 feet high, lies 1¼ miles south-eastward of Bath Bun island, and between Pascoe and Simpson shoals. *See* page 503.

PIG (GYUN GYI) ISLAND (*Lat. 15° 4′ N., Long. 97° 44′ E.*) consists of four distinct wooded hills connected by low sandy beaches, the southern and largest hill being 534 feet high, and steep on its eastern side. Shallow sands, on which the sea incessantly breaks, extend nearly 1½ miles westward of the island, and the southern extreme of the ridge, above mentioned, is 4¼ miles southward of it. There is deep water immediately eastward of Pig island and across to the mainland forming a good channel and secure anchorage.

Tamarind (Maji Gyun) island, 4 miles south-south-eastward of Pig island and 1½ miles off-shore, is small, triangular-shaped, and 260 feet high. The deep channel passes close westward of it.

Chart 823, Koronge island to White point.

Hoare island, 3½ miles further south-south-eastward, is similar but lower.

Chart 1272, Approaches to Yé river.

Livermore shoal is a ridge of sand 2½ miles long in a north and south direction, on which there are two patches with depths of 2 and 3 fathoms, respectively, the shoaler spot being 3½ miles westward of the summit of Stag island; the 10-fathoms line passes close westward of the shoal. Pagoda point just open northward of the northern end of Stag island bearing S. 64° E. leads northward of this shoal, and the lead is the best guide for passing seaward of it, the water not being shoaled to less than 12 fathoms in its vicinity.

Chart 823, Koronge island to White point.

Headlam patch, of small extent, with a least depth of 6½ fathoms over it, situated 5¼ miles west-south-west from the western end of Bath Bun island.

Shearme sand, the northern end of which is 8 miles westward of the north point of Pig island, extends in a north and south direction for a distance of 5½ miles, is a quarter of a mile broad, and has depths of from 6 to 10 fathoms over it.

Sinclair shoal extends nearly 5 miles in a north and south direction, is about 1½ miles in greatest breadth, and has depths of from 5 to 10 fathoms over it; its north end is 23 miles west-south-west of the south point of Pig island. Detached shoals, with depths of

9 and 10 fathoms over them, lie southward and south-westward of Sinclair shoal.

ROSS SAND, the northern end of which lies about 2 miles westward of the southern end of the shoal extending southward from Pig island and 6¼ miles from the land, is 7 miles in length in a north and south direction, and barely a mile in breadth anywhere, is steepest on its eastern side, and is generally discernible by discolouration and tide rips.

The general depths on the shoal are from 3½ to 5 fathoms, but near its northern part is a patch about 1¾ miles in length, with from 1½ to 3 fathoms over it, and there is a patch of 3 fathoms near the southern end. No directions can be given for clearing the sand, and the lead is of little use; bearings of Pig island, Moskos islands, and North and South peaks will fix the position.

It will be noticed that a chain of islands and ridges extends southward parallel to the coast for about 21 miles from Livermore shoal and Stag island, with no passages that can be recommended between them.

Chart 1272, Approaches to Yé river.

Pascoe shoal, lying about one mile off the bar of Yé river, is a narrow shoal of sand 1½ miles long in a north and south direction within the 3-fathoms contour line; the centre of the shoal has a depth of about one foot over it at low water, spring tides, when there is a depth of not less than 4 fathoms in the channel, and its northern end lies $1\frac{1}{10}$ miles south-westward of Pagoda point, the south extreme being a little south-eastward of Kyetiki Gyun.

The channel eastward of the shoal is the safer, and a useful leading mark, the eastern extreme of Aye island in line with the western extreme of the mainland, bearing N. 22° W., leads through it.

Simpson shoal, trending south for 2¾ miles from Kyetiki gyun, is similar in shape to Pascoe shoal, and has a least depth of one fathom, over sand and mud, near its centre. A channel half a mile wide, between this shoal and the long ridge extending southward from Bath Bun island, can be used by keeping Bath Bun and Stag island just touching, bearing N. 9° W.; but the channel eastward of Pascoe shoal is to be preferred.

Clearing mark.—Kyetiki gyun open westward of the high land over the coast to the northward, bearing N. 10° W., leads eastward of Simpson shoal.

Anchorage (*Lat. 15° 12′ N., Long. 97° 45′ E.*).—There is good anchorage for large vessels eastward of Stag island, with its northern extreme bearing N.W. by W. ½ W., and its southern extreme

S.W. by S.; and eastward of Pascoe shoal, on the leading mark, the eastern extreme of Aye island in line with the western extreme of the mainland, bearing N. 22° W., and Kyetiki gyun, S.S.W. ¾ W. There is also good anchorage eastward of Pig island.

Directions.—From the northward Ku-la-gauk island, and then Aye island under the high land, and Stag island further out, should be sighted, and the latter approached bearing S.E. by S., which leads 1½ miles South-westward of Aye island, and on making Pagoda point, which appears as a hummock at the end of a level stretch of beach, bring it in line with the western slope of Sidawtaung and a dip in the distant high land, bearing S. 52° E. (*View on 1272.*)

Keep this mark on, which leads about 1½ cables north-eastward of the shoal extending off the northern end of Stag island, and when the eastern extreme of Aye island is in line with the western extreme of the mainland bearing N. 22° W., steer S. 22° E., using it as a stern mark to lead to the anchorage eastward of Pascoe shoal.

To anchor eastward of Stag island (*Lat. 15° 12′ N., Long. 97° 44′ E.*) approach as above, and when the eastern end of Bath Bun island opens eastward of Stag island, bearing S. 8° W., steer about S. by E. ⅜ E. for the anchorage.

From the southward, pass inside Ross sand, which is generally marked by discolouration and tide ripples, with Pig island bearing North until Tamarind island bears N.E. Then steer for midway between Pig island and the mainland until Pagoda point is in line with a notched peak a short distance behind it, bearing N. 3° E. This mark leads eastward of Simpson shoal and to a position off the bar eastward of Pascoe shoal.

Tides.—It is high water, full and change, at Stag island at 0h. 13m.; springs rise 18 feet, neaps rise 12 feet; neaps range 3 feet. The lowest tides are in February and March. Inside the bar high water is 5 minutes later than outside, but the times of low water differ considerably, the escape of water at the bar being checked by the sands so that the tide outside commences to rise some time before that inside. Owing to this check the level of the water inside the bar at springs never falls so low as that outside.

When allowing for the rise of tide above the soundings on the chart it must be borne in mind that there is 3 feet less rise on the bar than there is outside. Owing to this, although neaps rise 12½ feet at Stag island, they only rise 9 feet on the bar, with minimum range only 7½ feet. As the bar nearly dries, this limits the entrance, at ordinary high water neaps, to vessels of less than 7 feet draught.

Tidal streams.—The flood tidal stream sets northward along the coast at a rate of about 3 knots at springs. The ebb sets southward at the same rate. At springs the water is much discoloured outside the islands.

YÉ RIVER (*Lat. 15° 11′ N., Long. 97° 46′ E.*), which enters the sea between Pagoda point and Sidawtaung, is said to have its source beyond the British frontier in Siam, and after passing through the hills eastward of Yé district flows through cultivated land past Yé town, whence it follows a very tortuous course to the sea, and at about half way divides into two branches, which join again near the mouth and form Chauma gyun, a large island, between them.

Depths.—The bar nearly dries at low water, and although the rise of tide is 15 feet at springs and 9 feet at neaps, the greatest depths to be expected with minimum range are 12 feet and 7½ feet, respectively; it must be remembered that there is always 3 feet less rise of tide on the bar than outside.

The river is only navigable for short vessels drawing less than 7 feet at neaps; but vessels drawing 13 feet might reach the town at springs.

Beacons (*Lat. 15° 10′ N., Long. 97° 48′ E.*).—The Outer beacon or western mark for crossing the bar is a diamond, painted white, surmounting a pole near the fishing stakes 6 cables north-eastward of Sidaw point.

The South inner beacon or eastern mark is a globe, painted white, in a tree at the edge of the mangrove north-eastward of Sidaw point.

North inner beacon for use in crossing the inner part of the bar is a triangle and diamond, painted red, in a tree a little distance northward of the South inner beacon.

Immediately northward of the eastern entrance point, which is the bluff west extreme of Sidawtaung hill, are two white balls, one on a pole on an outlying rock off the bluff, and the other on a tree on the east end of the same bluff.

At the mouth of Oagi chaung creek is a globe, painted white, in a tree, used for clearing the sands when across the bar and heading up the river.

To cross the bar.—It is necessary to cross the bar at high water, both for increased depth on the bar and so as not to carry a strong flood stream up the river, with which a vessel could not steer round its sudden bends and the numerous sands, which are difficult to clear.

At high water neaps not more than 7½ feet of water can be depended on, but within a day or two of spring tides there is always a depth of 12 feet at high water in the channel.

With the west extreme of the bluff under Sidawtaung bearing N.E. by E. the eastern and western marks are a little to the left of it, and the outer beacon (diamond, white, surmounting a pole) in line with the South inner beacon (globe, white, in a tree), bearing N. 50° E., lead across the outer part of the bar, until Pagoda point bears N. 38° W., with the end of the beach, one mile north-west of it, just shut in, when the two globes (one on a pole, the other on a tree) immediately northward of the western extreme of Sidawtaung will come in line, N. 70° E., and should be steered for until the outer beacon (diamond, white, surmounting a pole) is in line with the North inner beacon (red, triangle, and diamond, in the trees northward of the eastern mark), N. 48° E.

Steer with this last mark on until the extreme of the bluff bears South, when keep a little northward, bringing the western mark between North and South inner beacons. This leads in until the next reach of the river opens to the northward. Then keep Asun pagoda, a conspicuous object on the west bank of Asun Chaung, well open clear of Zibuthang point, which is the inner extreme of the entrance on the north side, bearing N. 10° W., and pass Zibuthang point at half a cable distant. Oagi chaung beacon (globe, white, in a tree) in line with Asun hill, bearing N. 16° W., also leads up this reach.

The river here divides into two branches, that to the northward past the pagoda being quite shallow when examined in 1887; Zibuthang reach, the other, trending eastward and north-eastward, leads, by somewhat intricate navigation, to the town of Yé.

Tides.—Inside the bar of the river it is high water, full and change at 12h. 18m.; springs rise 15 feet, neaps rise 9 feet; neaps range 2 feet.

At Yé town it is high water, full and change, at 1h. 8m., approximate; springs rise 13¼ feet, neaps rise 6¼ feet.

Tidal streams.—Over the bar and inside the river the first of the flood stream sets in the line of the channels, but when the sands are covered, and at neaps, when they do not uncover, it sets for Zibuthang point. The ebb sets similarly in a contrary direction, and tends to set a vessel coming down the last reach on to the sands southward of Zibuthang point. It is very strong in the channels after the sands are uncovered, and runs at a rate of 4 knots off Sidaw point.

In the upper reaches the streams follow the direction of the channels, eddies being met with under the lee of the bends. At Yé the flood runs for about 5 hours.

Yé (*Lat. 15° 15′ N., Long. 97° 51′ E.*), situated nearly 7 miles north-eastward of the bar in a direct line, is the capital of Yé district, which lies between Amherst and Tavoy, in the province of Tenasserim.

Chart 1272, Approaches to Yé river. Var. 0° 50′ E.

The range of hills on the southern side of the river entrance forms the boundary between Yé and Tavoy districts.

The town stands on high ground on the north bank of a bend of the river, and its pagodas are conspicuous for many miles. Its population was 3,500 in 1901.

Communication.—The British India S.N. Company have a fortnightly service of steamers to Moulmein, Tavoy, Mergui, and Penang, and there is telegraphic and postal communication.

Supplies.—Rice, fish, and vegetables are easily obtainable, also wood, which is the fuel used by the trading steamer.

Piers.—There are two piers built of wood, but the foundations of the older one having sunk, it is almost useless.

Trade consists chiefly in the import of tobacco, cotton and silk piece goods, earthenware, and porcelain; and export of paddy, salt, dunnies, sessamum, and boats.

Climate.—Fine weather prevails from the middle of November to the middle of March. Northerly and easterly winds prevail during the day, and westerly breezes in the afternoon, during February and March.

During February the weather is frequently hazy. The rainy season does not end till 15th November, and up to that date fever is prevalent. The temperature near the mouth of the river ranges from 80° to 90° at midday between November and March, and 60° to 70° in the early morning.

TAVOY DISTRICT, commencing at the south entrance point to Yé river, has a coastline of nearly 130 miles in length, and includes Heanzay basin and Tavoy river. (*See* Chapter I., page 54.)

Chart 823, Koronge island to White point.

COAST (*Lat. 15° 2′ N., Long. 97° 48′ E.*).—At between 8 and 9 miles southward of Sidawtaung the high land closes the coast, and the headlands become larger until White point is reached, which is 17 miles southward of the entrance to Yé river. North peak, 2,458 feet, and Krunangi or South peak, 2,580 feet high, are 1¾ miles apart, about 7 miles north-eastward of White point, but as there are other peaks of nearly the same height in their vicinity they are not easily distinguishable.

Chart 824, White point to Mergui.

The coast from White point is bold, rocky, and trends south-south-eastward 11 miles to Dolphins nose, the northern entrance point to Heanzay basin.

The coast for 10 miles southward of Dolphins nose should not be approached within 7 miles; north-eastward of northern Moskos island it can be approached nearer.

General charts 824, 830, 70.

Chart 824, White point to Mergui. Var. 0° 50′ E.

Anchorage.—Dolphins nose may be steered for bearing between E. by N. and E. by S., and anchorage obtained in a depth of 4½ fathoms, at about 1½ miles off the land.

Plan 3489, Heanzay basin.

HEANZAY BASIN, formed by three large creeks which unite and flow into the sea through a funnel-shaped estuary, between hills, 1,480 feet high, on the north and 810 feet high on the south side, is 2½ miles in length, in a north-east and south-west direction.

The shores of the three large creeks, which form the basin, are, with the exception of a few rocky points, fringed in all parts by mangroves, and are intersected by numerous smaller creeks; the whole district is sparsely populated.

These creeks are navigable by small craft for short distances.

Dolphins nose (*Lat. 14° 42′ N., Long. 97° 52′ E.*), the northern entrance point, is the abrupt termination of a hill, 1,000 feet high, and half a mile east-south-east of the point is Position rock, which is awash at high water, spring tides.

Kantaung promontory, the southern entrance point, is formed by an isolated hill, 420 feet high.

Dangers.—North sands extend for a distance of 4¾ miles in a south-south-west direction from the coast immediately westward of Dolphins nose, and are about 2½ miles in width, with depths under 12 feet, drying in patches at low water, spring tides.

South sands extend for fully 3 miles in a south-south-west direction from the south point of Kantaung promontory, and are about three-quarters of a mile in greatest breadth, with patches drying at low water, spring tides, for a distance of 2¼ miles from the promontory.

Entrance.—The entrance between North and South sands is obstructed by a bar, the outer part of which is fairly level; inside, between the sands, are a number of shoal patches, with, in places, comparatively deep water between them.

Depths.—The outer part of the bar has a general depth of 14 feet, and the entrance is easy of access at springs to vessels drawing 15 feet, or at neaps to those of 10 feet; if properly buoyed, vessels of 25 feet draught might enter at springs, and 19 feet at neaps.

Anchorage may be obtained anywhere after passing Kantaung promontory, but the depths are more convenient, and the tidal streams slacker, on the southern side.

There is good anchorage within the basin in a depth of 7 fathoms, over mud, mid way between Fish trap point and the south end of Kwéthongyima promontory.

General charts 830, 70.

Plan 3489, Heanzay basin. Var. 0° 50′ E.

Directions.—As the deepest draughts that should enter at springs and at neaps are 15 and 10 feet, respectively, no larger vessel should attempt to cross the bar without having previously buoyed the channel.

Vessels of light draught should steer for the northern part of Kantaung promontory, when bearing N.E., making due allowance for the tidal streams, which set across the bar, and when about three-quarters of a mile from the promontory shape a course to pass it at a distance of from a half to a quarter of a mile.

If proceeding into the basin, mid-channel should be kept until abreast East point, when steer more towards the southern side of the channel to avoid the spit extending from Kwéthongyima promontory.

Tides.—It is high water, full and change, at Kantaung promontory at 11h. 50m.; springs rise from 15 to 16 feet, neaps rise from 8 to 11 feet, and neaps range from 2 to 5 feet.

Within the basin the time of high water is from 20 to 30 minutes later, and of low water from the same time to 15 minutes later, than that at Kantaung promontory, while the range of tide, both at springs and neaps, is about one foot more.

Tidal streams.—In the offing the flood stream sets to the northward and the ebb to the southward, commencing to run at from 2 to 3 hours after the times of high and low water at Kantaung promontory, and attaining a velocity of from three-quarters of a knot to 1¾ knots.

Outside South sands the tidal streams set across the bar and along the eastern edge of the sands, their direction being parallel to the channel until the sands are covered, when they set slightly across them with an estimated velocity of from 1½ to 3 knots.

In the entrance to the basin the ebb stream makes at from a quarter to three-quarters of an hour after high water, and runs with a velocity of from one knot to 3 knots; the flood stream makes at from half an hour to one hour after low water, and flows with rates of from three-quarters of a knot to 1¾ knots.

Within the basin the ebb stream makes at about half an hour after high water, and the flood stream almost immediately after low water at Kantaung promontory.

Note.—The tidal observations, on which these remarks depend, were made during the dry season. During the rainy season the ebb will be considerably stronger than the flood, and, at its height, may possibly overcome it altogether.

Chart 824, White point to Mergui.

COAST (*Lat. 14° 41′ N., Long. 97° 52′ E.*).—From Kantaung promontory the coast trends in a south-south-east direction for nearly

General charts 830, 70.

Chart 824, White point to Mergui. Var 0° 50′ E.

25 miles to an unnamed point, near which is a pagoda, and which is the northern point of Maungmagan bay; Tapir hill, situated 7 miles from Kantaung promontory, is 1,240 feet high and nearly one mile from the coast.

At 16 miles from Kantaung promontory is the entrance to a creek which communicates with Heanzay basin, and 4 miles south-eastward of it Nabulé punkhun rises to 3,805 feet; it is a fine peak from northward or southward, but blunt from the westward.

MOSKOS ISLANDS, consisting of three groups, Northern, Middle, and Southern, which are known to the Burmese as Heanzay, Maungmagan, and Laung lun, extend in a chain parallel to the coast for a distance of 41 miles from North islet, which is situated 11 miles south-west of Tapir hill. Around these islands is an extensive unworked area of pearling ground.

The channel between the islands and the mainland is generally from 8 to 10 miles in width, with depths of from 11 to 18 fathoms, but between North ledge and the shoal extending northward of North island it is reduced to 2½ miles; abreast the Northern and Middle groups the 10-fathoms contour line is from 3 to 6 miles off the coast, and the area within it is only partially sounded.

The coast bank of soundings appears to extend a great distance westward of the Moskos, there being depths of 50 fathoms at a distance of 65 miles in that direction.

Northern Moskos, almost united to Middle Moskos by scattered islands and rocks, are straggling islands of various sizes, with several rocks above water. Long island (Hinzé bak), 1,070 feet high and near the northern end of this group, is the largest, and Quoin island, the southernmost of this group, is 1,177 feet high.

North islet (*Lat. 14° 27′ N., Long. 97° 47′ E.*), the northernmost of this group, has rocks 28 feet high nearly three-quarters of a mile north-north-eastward of it, and 4½ miles in the same direction is North ledge, 3 feet high, with apparently no other rocks near it; a reef about a mile in extent is charted at 1¾ miles northward of North islet.

Middle and Southern Moskos are the largest and highest of these islands, the southernmost island being 1,180 feet high; rocks, awash at high water, and a small rock, 155 feet high, are situated nearly one mile south-south-west and south-south-east, respectively, of the southernmost island. The channel between Middle and Southern groups, about 12 miles wide, is believed to be clear, and the islands appear steep-to on their western side.

Vessels proceeding inside Moskos islands by day pass eastward of North ledge, where approach to Heanzay banks is indicated by the lead.

General charts 830, 70.

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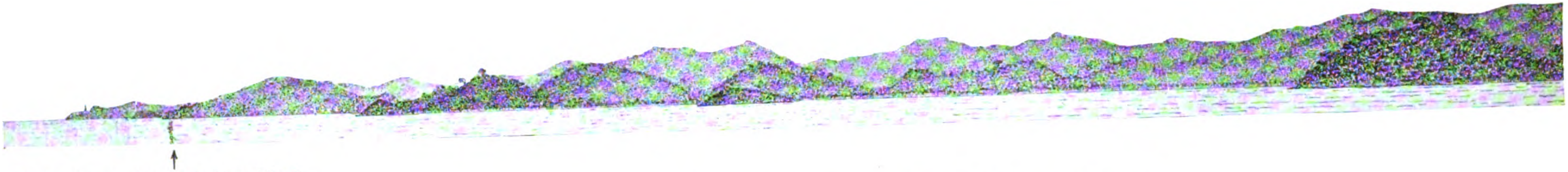

The north-east point of Grindstone island, in line with the western end of Button islet, bearing S. 8° E.

Leading mark for the Western channel, Tavoy river.

Chart 824, White point to Mergui. Var. 0° 50′ E.

Anchorage.—There is said to be good anchorage in bad weather southward of the islet, 116 feet high, off the middle of the eastern side of the largest Southern Moskos island.

Tides.—It is high water, full and change, at Long island at 11h. 40m.; springs rise 16½ feet, neaps rise 10 feet.

COAST.—Maungmagan bay is 16 miles in width between its north and south points, and recedes about 4 miles; it has low shores with sandy beaches on its northern portion, but further south the high land, which, in Taungbataung, reaches a height of 1,552 feet, approaches to within 2 miles of the coast.

A Government bungalow, used by the European officials of the Tavoy district, is situated about 2½ miles north-westward of Taungbataung.

From the south point of Maungmagan bay the coast trends south for 18½ miles, and then slightly to the eastward for 11 miles to the extreme of the promontory which forms the western side of the entrance to Tavoy river; this coast appears bold and rocky, but its northern part is skirted by sunken reefs to the distance of about a mile.

A mountainous ridge extends north and south a short distance inland; and on Lakhiataung, one of its summits, 1,960 feet high, situated 11 miles southward of Taungbataung, is a pagoda; 7½ miles south-south-west of Lakhiataung is a bluff headland or point, with an islet, 431 feet high, off it, and there are also several small islands further southward.

Telegraph station (*Lat. 14° 8′ N.; Long. 98° 6′ E.*).—The Government bungalow is a telegraph station.

General charts 830, 70.

CHAPTER X.

COASTS OF TENASSERIM AND SIAM.—TAVOY RIVER TO SALANG AND BROTHERS ISLANDS, INCLUDING MERGUI ARCHIPELAGO.

(*Lat. 14° 5′ N. to Lat. 7° 25° N.*)
(*Long. 96° 34′ E. to Long. 99° 0′ E.*)
VARIATION : Decreasing about 2 minutes annually.

Chart 830, Bassein river to Pulo Penang. Var. 0° 50′ E.

TAVOY RIVER (*Lat. 13° 33′ N., Long. 98° 13′ E.*), having its main sources near the northern boundary of Tavoy district, in the western slopes of the range separating Burma and Siam, is about 120 miles in length, and has a depth of 12 feet throughout the year from Reef island to Tavoy, a distance of 47 miles, and of 5 feet from Tavoy to Yebyu, a further distance of 16 miles.

The river enters a broad plain about 3 miles above Tavoy, and its course is impeded by sandbanks and alluvial islands, constantly changing in form and position, which obstruct the river until the estuary is reached.

Plan 924, Tavoy river.

Many tidal creeks intersect the plain between the banks and the base of the hills on both sides of the river, and the Labachaung, the Pyinbugyichaung, and the Mindatchaung, three small rivers, the entrances to the two latter blocked by an extensive mud flat, flow into the north-east side of the estuary.

At the mouth of the Tavoy river are extensive unworked areas of pearling ground.

Aspect.—The hills run in parallel ranges generally north and south; rising at Tavoy point (Shin maw) directly to a height of 1,120 feet, they gradually recede from the western side of the river, and at Goodridge plains are 1½ miles off, and nearly 2,000 feet high; they close the bank again abreast Tavoy.

On the eastern side of the estuary are low hills, with parallel ridges behind them gradually ascending to about 4,000 feet at the

General charts 824, 830, 70.

Nyataung range, of which Buktaung, a summit 2,195 feet high, is abrupt and conspicuous, rising from a small range near the coast.

Thejaungtaung, 2,010 feet high and similar in appearance, is also conspicuous; it is situated 9½ miles northward of Buktaung, and is a good mark to steer for after rounding Tavoy point, and before shaping course up the river.

Northward of Elbow point (Thamókmo), the hills close the left bank, and at Tsinbyubyin are 1¼ miles off, maintaining about that distance to Tavoy, where they recede, and rise in successive ranges to Nwa-la-bo range, with its conspicuous peak, 5,063 feet high, which is 14 miles eastward of the town.

CAP ISLET (Hnet thaik taung) (*Lat. 13° 32′ N., Long. 98° 8′ E.*), nearly circular, about 3 cables in diameter, and situated off the western entrance point, is 523 feet high, and steep-to except on its eastern side, whence a shoal spit with depths of from 17 to 28 feet extends eastward about 3 cables. The channel between Cap islet and the main is clear, with depths of about 8½ to 17 fathoms, and may be used by steam vessels; but the tidal streams in it have a velocity of 3 knots at springs.

Tavoy point (Shin maw), the western entrance point to the river, marked by a pagoda, is the south-eastern extreme of a small peninsula, which is 1,120 feet high, and steep-to.

Byikhwaaw, the bay between the point northward of Cap islet and Tavoy point is about 1⅓ miles in width, with depths of from 24 to 30 feet, but is shoal for half a mile from its head.

Kiantaung, 1,280 feet high and 3½ miles north-westward of Tavoy point, is covered with forest, but shows a light clearing from eastward and westward.

Puklaji, 7 cables north-north-eastward of the north-eastern extreme of Tavoy peninsula, is a patch with a rocky head showing at low water, spring tides.

Reef island or Gogaligyun, about 3 miles north-north-eastward of the northern side of Tavoy peninsula, is a mile long in a north and south direction, 3 cables wide, and 470 feet high; clearings of the trees, which have been made in places for the passage of the light rays, are conspicuous.

LIGHT.—A square masonry tower, 25 feet in height, painted white with a white dome, and situated on a hill near the north-eastern point of Reef island, exhibits at an elevation of 309 feet above high water, a *white fixed* light, which should be visible in clear weather from a distance of 12 miles.

Plan 924, Tavoy river. Var. 0° 50′ E.

Dangers.—A shoal, on which the depths are from 6 to 15 feet, extends half a mile in a south-south-west direction from the south extreme of Reef island.

At nearly 2 cables south-eastward of the south-east extreme of the island is the northern extreme of a shoal of sand, with depths of from 4 to 18 feet, which extends, with a width of about 3 cables, for a distance of $1\frac{2}{10}$ miles in a south-south-west direction, the least water being in its centre.

Whale rock (Gogalichaukpon), a reef of boulders lying 2 cables eastward of the south-east end of Reef island, and 4 cables south-south-eastward of the lighthouse, is just covered at high water, spring tides, and should not be approached within a cable.

Clearing mark.—The north-east extreme of Grindstone island, just open eastward of Reef island, bearing N. 14° W., leads eastward of the above dangers. (*View on 924.*)

Landing.—Boats can land on the beach about 2 cables southward of the lighthouse, to which there is a good road.

Water may be procured from a well near the landing place.

Middle island or Thombongyun, half a mile north-westward of Reef island, is $2\frac{3}{10}$ miles long in a north and south direction, 9 cables wide, 725 feet high, and thickly wooded. It is inhabited only during the fishing season, from January till April.

The bay between Middle island and Tavoy point is full of shoals and drying banks.

Button islet or Satlugyun (*Lat. 13° 38′ N., Long. 19° 12′ E.*), about a cable off the middle point on the eastern side of Middle island, is of granite and covered with trees, the tops of which are 162 feet high.

A shoal ridge, on the middle of which is Oyster rock, 3 feet above water, extends south-south-westward for nearly 3 miles from Button islet, passing between Reef and Middle islands.

Grindstone island or Kathemawgyun, situated 4 cables northward of Middle island, is about three-quarters of a mile long, half a mile wide, 550 feet high, and densely wooded; between the northern side of the island and a point about one mile to the northward is a bight filled with a flat that dries, and at the north-east point of the island is a large granite boulder, with a pagoda on it.

Mahratta or Yabaichauk rock, 2 miles northward of the north-eastern point of Grindstone island, and nearly 7 cables off the west bank of the river, is a pinnacle with a depth of 7 feet over it at low water, spring tides, and from 19 to 26 feet around; it is marked by a strong ripple.

General charts 824, 830, 70.

Plan 924, Tavoy river. Var. 0° 50′ E.

Rocky ground, with a depth of 18 feet on it, lies 4 cables eastward of Mahratta rock, and the bottom in the locality is generally irregular and hard.

Chaukdaw rock, $4\frac{2}{10}$ miles northward of Mahratta rock and 2 cables from the west bank of the river, has 12 feet over it at low water, spring tides.

Leading marks.—From about a mile northward of the north-eastern point of Grindstone island, that point in line with the western side of Button islet, bearing S. 8° E., leads in the fairway eastward of Mahratta and Chaukdaw rocks; and the conspicuous fall on the southern side of Tawantaung hill, bearing southward of W.S.W., leads northward of Chaukdaw rock.

Eastern shore.—The hills behind the eastern side of the estuary have been described on page 512, and the coast is flat open land, with clumps of trees and paddy cultivation, and several small hills from about 250 to nearly 1,000 feet high, dotted over it.

Nauwi rocks, 4 feet high, are situated 5¼ miles south-westward of Buktaung peak, and 2½ miles off-shore, and from immediately northward of them the edge of a shoal, with depths of less than 18 feet over it, stretches in a north-west direction for about 5 miles, and then westward for about 3 miles, to a position about 7 miles south-westward of the eastern shore, and more than half-way across the estuary; from this position the edge trends northward nearly up the middle of the river.

Rocky, dangerous ground and sand and mud flats, which dry, extend from one mile to 2 miles off this side of the estuary, and off the entrance to the three small rivers already mentioned the mud flat extends about 2½ miles off.

Elbow point (Thamókmo) (*Lat. 19° 43′ N., Long. 98° 14′ E.*), about 1½ miles northward of the entrance to these rivers, is densely covered with mangroves, and from it the east bank of the river, consisting of paddy fields with clumps of trees, extends in a northerly direction for 7½ miles to Tsinbyubyin.

Crab island or Pinjigyun, thickly covered with trees, and about 30 feet high, occupies the middle of the river for 6¼ miles in a north and south direction, its southern end being 2 miles north-west of Elbow point. On its east side, and about three-quarters of a mile and nearly 2 miles southward, respectively, of the north point, are conspicuous trees, each 50 feet high.

From the southern end, a spit of sand and mud, dry in places, extends south-south-eastward within depths of 12 feet for nearly

5¾ miles, and is prolonged in the same direction for one mile within depths of 18 feet, dividing the river into two channels. Near its extreme of 12 feet a large fish trap, placed in 10 feet at low water, existed a few years since, but its existence must not be relied on.

New island or Shityangyun (*Lat. 13° 51′ N., Long. 98° 14′ E.*), joined to the northern end of Crab island at low water, spring tides, appears to be rapidly extending northward. A succession of similar low alluvial islands, connected by shoals, stretch up the river as far as Tavoy. Vessels of 12 feet draught cannot proceed beyond New island.

Entrance.—The entrance to the river, between the east side of Tavoy peninsula, and the shore which extends 7 miles off the eastern side of the estuary, is 4¼ miles in width, but between Reef island, Whale rock, and the shoal southward of it, on the west, and the edge of the same shoal, on the east side, it is reduced to 2 miles, and further reduced to about 8 cables between Grindstone island and the shoal extending southward from Crab island.

Depths.—From the entrance, where the depths are from 5 to 14 fathoms, and with the exception of a narrow bank, with 28 and 29 feet over it, which apparently connects the north-east side of Reef island with the south extreme of the shoal extending southward of Crab island, there are depths over 30 feet to nearly one mile above Grindstone island, from this the channel westward of the shoal extending southward of Crab island, has depths over 18 feet, for about 3½ miles, and 12 feet for 4¼ miles to the anchorage off Goodridge plains; this latter depth being continued so far as Tavoy throughout the year.

In the channel eastward of Crab island, leading to Tsinbyubyin anchorage, a bar which extends from Elbow point to the south side of Crab island has a depth of 6 feet over it.

Anchorages.—There are a number of anchorages in the estuary, and up the river; the outermost being northward of Tavoy point, where good shelter may be obtained, without being too close to Puklaji patch.

Northward of the same patch there is anchorage in a depth of about 24 feet, from 3 to 7 cables southward of the shoal extending from Oyster rocks.

Anchorage in from 36 to 42 feet water, over mud, may be obtained eastward of Reef island lighthouse, with Whale rocks in line with the east extreme of Tavoy peninsula, bearing S. 30° W.

A berth may be taken up north-eastward of Middle island, in about 36 feet water, and half a mile north-north-eastward of Button island.

Anchorage in the fairway eastward or north-eastward of Grindstone may be obtained in from 36 to 42 feet water, and the three last-named anchorages may be reached by a vessel of deep draught.

Further up the river there is anchorage in the fairway, about one mile west-south-west of the south point of Crab island, in a depth of about 20 feet.

Off Goodridge plains (*Lat. 13° 48′ N., Long. 98° 11′ E.*), anchorage may be taken up, in about 13 feet water, over mud, nearly 3 miles south-south-west of the north point of Crab island, and off Tsinbyubyin, 1¼ miles eastward of the same point, and in the same depth.

Directions.—Entering the river, after rounding Tavoy point, which is steep-to, steer N.E., and if intending to anchor northward of Puklaji, bring Button island in line with the western extreme of Reef island, bearing N. 1° E., and steer for it until Kiantaung, or the centre of the sandy beach fronting it bears W. by N., or until Fishermans island bears N.W. ¼ W., when the latter may be steered for to the anchorage.

If proceeding to any of the anchorages further up the river, keep Tavoy point, bearing westward of S.W. ½ W., astern, until the north-east extreme of Grindstone island is just open eastward of the east side of Reef island, bearing N. 14° W., when alter course to N. ¾ W., to pass 2 cables eastward of Whale rocks, and, if required, to the anchorage eastward of Reef island. (*View on 924.*)

Or continue the N. ¾ W. course until 5 cables eastward of Button islet, when alter course to N. by W. ⅝ W., which passes close to the anchorages north-eastward of Middle island, and eastward of the south point of Grindstone island, and 2 cables eastward of the north-east point of Grindstone island, past which the tidal streams run strongly; if intending to anchor north-north-east of Grindstone island the course must be altered slightly to the northward for this anchorage.

But if bound to one of the anchorages higher up the river, continue the N. by W. ⅝ W. course until the north-east point of Grindstone island is in line with the western end of Button islet, bearing S. 8° E., when steer N. 8° W. with this mark on astern until the southern slope of Tawantaung bears southward of W.S.W., when close the west bank of the river, and continue along it at a distance of 1½ cables, until just beyond the port tide gauge at Goodridge plains, where there is an open space, with a tank and rest house, and anchor in 13 feet water over mud, at low water spring tides. (View page 517.)

A short and handy vessel, not drawing more than 8 feet, can proceed to Tavoy, but should take a pilot at this anchorage, where there is a pilot station.

To Tsinbyubyin by the East channel.—As the bar with a depth of about 6 feet at low water, which crosses the river from Elbow point to the south-east side of Crab island has to be passed, the tidal rise and the draught of the vessel should be considered before proceeding to the anchorage at Tsinbyubyin.

From 5 cables eastward of Whale rocks steer N. ½ E. for the western extreme of Elbow point, until the northern extreme of Middle island bears W. ¾ S., when the large fish trap at the end of the central spit, if in existence, should be in line with that extreme; then steer N. by W. ½ W. for the left extreme of Crab island, until the projecting mangrove point next south-eastward of Elbow point bears E. by N. ¾ N., and alter course to N. by E. ½ E., to pass Elbow point at a distance of about 3 cables.

From abreast Elbow point gradually close the east bank of the river to one cable, continuing at this distance until the southern end of New island bears S.W. by W. ¼ W., which is the anchorage for vessels of not over 12 feet draught, and extends off Tsinbyubyin to about 3 cables northward of the bungalow, and is a cable broad; the bottom is soft, and the tidal stream runs about 3 knots at half flood.

Above Tsinbyubyin local knowledge is necessary, as shoals are numerous and the channels continually alter. A steam launch can proceed from Tsinbyubyin to Tavoy, making the distance in 2 hours, by leaving at half flood near spring tides; but at neaps during the height of the rains, the flood stream is not felt above New island.

Off Tavoy (*Lat. 14° 4′ N., Long. 98° 12′ E.*) there is only room for a cargo boat to swing. The fortnightly steamer arrives at high water, turns, and moors to a pontoon which is secured to the bank.

Sailing vessels from Tavoy or Mergui during the South-west monsoon may experience difficulty in obtaining an offing, and a favourable opportunity should be taken to leave either place. In bad weather, work to windward with the anchorage under Tavoy point, or that under Tavoy island, open, until sufficient offing is obtained to weather the islands of the Mergui archipelago if bound southward, or of reaching the coast of Pegu westward of Rangoon river if bound northward.

Tides.—It is high water, full and change, at Reef island at 10h. 26m.; springs rise 15½ feet, neaps rise 10½ feet; neaps range 5¼ feet. At Tsinbyubyin it is high water 18 minutes later than at Reef island; springs rise 16¼ feet, neaps rise 11 feet; neaps range

Plan 924, Tavoy river. Var. 0° 50′ E.

6¼ feet. At Tavoy it is high water, full and change, at 12h. 0m.; springs rise 12 feet (approximate).

Tavoy town (*Lat. 14° 4′ N., Long. 98° 12′ E.*), the head-quarters of Tavoy district, is low lying, and all except the central portion is liable to be flooded at high tides; the river is on its western side, and south-west of it rice and timber mills extend along the bank for a distance of about 2 miles.

The town is well laid out, with three main thoroughfares parallel to the river, and all the Government buildings are in the centre, except the jail and the military police barracks, which are situated on higher ground to the east; the houses are mostly of timber, thatched with dani palm, and the town is well wooded throughout and abounds in gardens. In 1901 it had a population of 22,371. The main wharf is about 36 miles from Tavoy point. The rainfall is heavy, averaging 190 to 220 inches annually.

Communication.—Steam vessels of the British India S.N. Company run weekly from the mouth of the river to Rangoon and Mergui, and fortnightly to Moulmein, Yé, and Penang. Steamers trading with the Straits settlements call frequently at Tsinbyubyin, where there is a rest house and a good road to Tavoy; there is telegraphic communication.

Supplies of various description can be obtained.

Storm signals are shown at Tavoy. *See* pages 74-76.

Trade.—The trade, which is not of great importance, is chiefly with Rangoon, Mergui, Calcutta, and the Straits settlements, the chief exports consisting of rice, silk, waistcloths, salt, and dani palm, and imports of raw silk, tobacco, piece goods, sugar, kerosene oil, twist, yarn, and til seed. Silk weaving is the main industry, there being about 1,000 looms; pottery is manufactured, gold and silver worked, and there are rice and timber mills.

Chart 824, White point to Mergui.

COAST.—From abreast of Nauwi rocks, the coast trends south-south-eastward and southward for 62 miles to Kalwin point, and is bordered by extensive flats of sand and mud, which extend in places for a distance of nearly 10 miles off the land, and as the coast is unsurveyed caution is necessary in its vicinity.

MERGUI ISLANDS extend from Tavoy island, the north extreme of which is nearly 20 miles southward of Tavoy point, to Sayer islands, a distance of about 270 miles, Great Western Torres islands, the most outlying, being about 70 miles off the mainland; there are many small barren rocks in the archipelago, usually with deep water near them. The islands are fully described in Chapter I., page 57.

Chart 216a and b, Mergui archipelago.

Routes.—The navigation amongst the islands between Tavoy and Pakchan river, a distance of about 210 miles, is almost completely sheltered for steam vessels and small sailing craft.

The best route for steam vessels is westward of Domal and Bushby islands, through Forrest strait, and eastward of Hastings and St. Matthew's islands. Small vessels pass eastward of Domal and Owen islands, but the passage near the northern part of Domal island dries almost across at low water springs, leaving a narrow channel through sandbanks, named Celerity passage. *See* Tracks on 216a and b.

Depths off-shore.—The bank of soundings extends for some distance outside most of the islands, but it has not been examined; although the water near some of the islands is deep, approach to them would probably be indicated by the lead.

CAUTION.—In passing through any of the channels, or inside the islands, in addition to the use of the lead, a good lookout is imperative, as probably more reefs exist than are shown on the chart.

The channels between the outer islands are so imperfectly known that none of the central entrance channels from seaward, except Nearchus passage in lat. 11° 50′ N., Forrest strait in lat. 11° 5′ N., and Investigator channel in lat. 10° 15′ N., should be attempted. If northward of these, it is better to approach the mainland only between Tavoy point and Tavoy island, or, if southward, by passing south of Chance island in lat. 9° 20′ N.

Chart 824, White point to Mergui. Var. 0° 50′ E.

TAVOY ISLAND (*Lat. 13° 5′ N., Long. 98° 16′ E.*), situated from 11 to 17 miles from the mainland, is about 18 miles in length in a north-north-west and opposite direction, 5 miles in greatest width, and its highest part, about 7 miles from its northern extreme, is 2,245 feet high; although considered fertile, there are only a few houses and some families of Selungs settled on the island.

The western side of the island is very steep, and a string of islets and rocks extends southward for about 5 miles from its southern point. The caves in the hills of the island are the breeding places of the edible-nest-building swift, and the right of taking the nests, which are exported to China, is leased by the Indian Government.

The channel between the island and the main is navigable, and affords anchorage; eastward of the northern part of the island its width is contracted to about 2½ miles by a bank, the 5-fathoms contour line of which extends about 9½ miles from the mainland, and the depths between the edge of the bank and the island, through which

Chart 824, White point to Mergui. Var. 0° 50′ E.

the tidal stream sets with a rate of 1½ knots at springs, are from 7 to 18 fathoms. The lead gives warning of approach to the bank off the mainland, towards which the flood tidal stream sets.

Water.—On the south-eastern side is a pagoda, near which good fresh water can be obtained.

Plan of Port Owen on 835.

Port Owen (*Lat. 13° 6′ N., Long 98° 18′ E.*), on the north-eastern side of Tavoy island, affords good anchorage protected from the eastward by Edward, William, Rich, and Campbell islands, all connected by a shallow flat drying at low water, and further south by a mud flat, with from 2 to 3 fathoms water over it, which extends in a south-south-east direction from these islands to within a quarter of a mile of Fisher peninsula, which projects from the eastern side of Tavoy island.

Depths.—The depths in the northern entrance channel are from 6 to 8 fathoms, and in the narrow channel between the extreme of the mud bank and the northern side of Fisher peninsula, 4½ fathoms; in the harbour they are from 7 to 13 fathoms.

Missionary station.—Port Owen is a missionary station, and fresh water and wood are easily obtained.

Tides.—It is high water, full and change, at Port Owen, at 10h. 50m.; springs rise 20 feet.

Tidal streams.—The flood stream sets fairly southward and in the direction of the trend of the harbour at a rate of 3 knots at springs.

Chart 824, White island to Mergui.

GREAT CANISTER, a conical island, about 6 miles westward of the southern part of Tavoy island, is 2 miles in length in a north and south direction, one mile in breadth, and 1,084 feet in height; the depths near it are unknown. About 3 miles north-eastward of Great Canister, between it and Tavoy island, are three high black rocks or islets; and, at about 4 miles south-eastward of Great Canister, is a group of high rocks, which should be given a wide berth.

Little Canister islet, 5½ miles south-south-eastward of Great Canister, is conical, 990 feet high, covered with trees, and apparently bold and rocky. No soundings have been obtained within 1½ miles of it, but there are depths of from 19 to 30 fathoms charted between it and Great Canister.

Cabosa island, the northern of the outer Mergui islands, has several summits, the south-western being 1,388 feet high; it is covered with jungle.

General charts 830, 70.

Chart 824, White point to Mergui. Var. 0° 50′ E.

West Canister islet, small, steep, high, and covered with jungle, is situated about 8 miles south-westward of Cabosa island, with Investigator passage, in which there are some depths of from 30 to 35 fathoms, between; the northern end of this islet slopes gradually and is of a snout-like shape. About 4 miles eastward of West Canister is a group of pinnacle rocks, one of which is 30 feet high.

Freak islet, 5 miles southward of the south-eastern point of Cabosa island, and nearly midway between it and Tenasserim island, is low, with a few scraggy trees on it, and is surrounded by rocks.

Tenasserim island, 10¼ miles southward of Cabosa island, is about 2½ miles in extent, and its peaks, about 2,000 feet in height, appear from a distance like two or three islands. Herbert and Howard islands lie off its northern end, the latter being distant about 1½ miles from it. Off the eastern and south-western sides of Tenasserim island, distant about a mile, are detached islets of which nothing is known.

Brown rock (*Lat. 12° 41′ N., Long. 98° 11′ E.*), about 8 miles south-south-west of Little Canister, is 66 feet high, with rocks which occasionally dry northward and southward of it; it should not be approached nearer than 4 miles. A sunken reef has been reported nearly 3 miles westward of Brown rock, but its existence is doubtful.

Chart 1075, Approaches to Mergui harbour,

Thamihla or Iron island, situated between the southern of the islets extending from Tavoy island and Kings island, rises to a height of 1,203 feet near its southern end. Off its northern point are rocks which dry at low water, and a bank, on which the depths are 8 fathoms, extends about 1½ miles from its eastern side.

Directions.—Entering from the westward, pass northward of Cabosa island, and thence steer either for the channel northward of Thamihla island, or that between Thamihla and Kings islands. In the channel northward of Thamihla island there are very strong eddies and tide rips, especially during the South-west monsoon. There are also strong streams and eddies in the channel between Thamihla and Kings island.

Tides.—It is high water, full and change, at Cabosa island at about 8h. 0m.

Tidal streams.—In the channels northward and southward of Thamihla island, the flood stream appears to set eastward, and the ebb westward.

Maingy island, off the western side of Kings island, and separated from it by a narrow channel believed to be unnavigable, is about 1,800 feet high and is said to have abundance of lead ore; this island may be seen from a distance of about 35 miles.

KINGS ISLAND, north-westward of Mergui, is 23 miles long in a north and south direction, 11 miles in greatest breadth, and is about 2,800 feet in height near its north-west side; it is rich in alluvial land and fine forest trees, and has a scanty population of Karens and Burmese.

Kings island sound (*Lat. 12° 37′ N., Long 98° 25′ E.*) is formed between the north-east part of Kings island and Plantain island, which is apparently a peninsula stretching northward from the east side of Kings island; Kama Taung, at the northern end of Plantain island, is 1,361 feet high, and 4 cables off the north-west extreme of the island is Panella islet, 10 feet high.

The sound is 2¼ miles in width between these entrance points, and extends to the southward for about 4¼ miles, but, with the exception of about half a mile within the entrance, it is filled by banks, which dry at low water, extending from each side, and fronted by shoal water; between these drying banks is Htein Chaung, a channel which is known to extend for about 2 miles into the island, and was supposed to communicate with Fell passage on the east side of the island, and to be used by canoes.

Lys shoal, two rocky patches, the north-western with a depth of 1¾ fathoms over it, lies one mile north-eastward of the northern entrance point of Kings island sound; the south-eastern patch has 2 fathoms water over it.

Clearing marks.—The south-west extreme of Thamihla island bearing N. 53° W., with Little Canister islet just shut in by it, leads north-eastward, and the northern entrance point of the sound bearing W.S.W. leads southward, of Lys shoal.

Anchorage.—The anchorage in a depth of about 7 fathoms is with the eastern extreme of the northern entrance point bearing N. by W. ¾ W., distant nearly half a mile, but as this anchorage is only about 1½ cables from the edge of a shoal with a depth of 2 fathoms, soundings should be taken round the vessel to ascertain that the berth is clear; vessels of light draught can anchor off the watering place, about a mile south-west of the north entrance point of the sound.

Water.—Boats can obtain water at half flood from a stream on the north-western side of the sound, where there is a stony beach and a small rocky islet.

Tides.—It is high water, full and change, at Kings island sound at 10h. 45m., and the rise of tide is from 12 to 16 feet.

General charts 216a, 830, 70.

Chart 1075, Approaches to Mergui harbour. Var. 0° 50′ E.

In the perigee springs of February or March the tide may fall a foot lower than the datum to which the soundings on the charts are reduced.

Chart 824, White point to Mergui.

INNER ROUTE TO MERGUI.—Steam vessels from the northern ports of Burma pass eastward of Tavoy island, keeping about 2 miles from it to avoid the shoal water extending 9½ miles from the shore abreast its northern point.

MERGUI DISTRICT, the northern limit of which is the stream discharging near Tatouk, eastward of Tavoy island, has a coastline of about 200 miles in length to Victoria point, and includes Mergui harbour. *See* Chapter I., page 56.

Canister Bank or Kumla islet, 12 miles north-eastward of the southern end of Tavoy island and about 7 miles off the mainland, is 575 feet high and rounded. There are some rocks on its north-eastern side.

Amyinpoma islands (*Lat. 12° 55′ N., Long. 98° 33′ E.*), about 2½ miles off the mainland and 14 miles eastward of the southern end of Tavoy island, are two small islands lying close together in a north-west and south-east direction. The northern is conical, 529 feet high, and the southern is 370 feet high. A group of rocks lies about 1¼ miles north-north-westward of the northern island.

Bowers reef, a rocky patch, half a cable in extent, which dries 6 feet, lies 1½ miles south-westward of the southern Amyinpoma island.

Chart 1075, Approaches to Mergui harbour.

Kawdwé or Long island, 5¼ miles southward of Bowers reef, is 457 feet high and narrow, appearing round from the northward and southward; there is foul ground and shoal water extending 1¼ miles off its western side.

Cone islet, small, conical, and 138 feet high, lies three-quarters of a mile east-south-east of the southern point of Kawdwé island; rocks, awash, lie 2 cables south-west of the islet.

Three-quarters of a mile north-eastward of Cone islet is a group of rocks 35 feet high.

Kawdwé rocks, on a patch about 3 cables in length in a north and south direction, are 2 feet high, and lie 2½ miles southward of Kawdwé island, on the eastern edge of the channel.

Pyin-ban islet, 3½ miles south-eastward of Kawdwé island, is 82 feet high and bare, and Peak islet, half a mile further south, is 128 feet high, with a rock awash southward of it. White rocks,

Chart 1075, Approaches to Mergui harbour. Var. 0° 50′ E.

14 feet high, are situated about 1½ miles further south, and south-south-west and south-south-east of White rocks are others that uncover. At about one mile to 2 miles eastward of this group there is a higher chain of islands, 2 to 4 miles from the mainland, which also appears high from the channel.

Thitya or Barn islet is a square precipitous rock, 86 feet high. Cap rock, 22 feet high, and small, lies 1 8/10 miles north-westward, and High rock, 37 feet high, 3 1/10 miles north-eastward of Thitya.

A sandbank with 5 feet over it at low water, spring tides, lies nearly 3 miles south-south-westward of Thitya islet and close to the channel leading to Mergui; eastward of this bank the water is shoal.

NORTHERN APPROACH TO MERGUI.—West side.—Kala island, separated from Plantain island by Fell passage, a channel about three-quarters of a mile wide, is nearly 7½ miles in length, with an average breadth of 2 miles, and 429 feet high at its north-east end; it is bordered by mangroves and has several hills along its western shore.

On the western side of the northern entrance to Fell passage, and 2 miles northward of Kala island, is Sa, a small steep island, 322 feet high, and northward of Kala island, forming the eastern side of the entrance to the same passage, are flats, which dry, fronted by a shoal, the whole extending for 2½ miles; Kawmwé islet, about 2 cables in extent and 200 feet high, is situated on the north extreme of the eastern of the drying flats.

East side.—Kalwin point is the north-west extreme of Mergui island, and the south entrance point to Kiaupi river, the channel into which, northward of Kalwin point, is only about a cable in width, and from its northern side the edge of a shoal extends about 9¾ miles in a north-north-west direction, forming the eastern side of the channel of approach to Mergui harbour.

With the exception of a channel, with depths of from 4 to 15 fathoms, which runs along the eastern side of Kala island nearly to its south end, the whole of the space southward of a line joining Kawmwé islet and Kalwin point is filled with islands, banks which dry, and shoals.

Plan 218, Mergui harbour.

Light.—A *white fixed* light is exhibited at an elevation of 25 feet above high water, from an iron pile beacon, painted black and placed in a depth of 7 feet off Kalwin point; the light should be visible, in clear weather, from a distance of 9 miles, but being unwatched it is unreliable.

Plan 218, Mergui harbour. Var. 0° 50′ E.

Outer anchorage.—The outer anchorage, in mid-channel of the approach to Mergui, is in depths of from 5½ to 6 fathoms, and from about 1½ miles to one mile distant from the light beacon, with Patawtaung hill on Madramakan island, bearing between S. by E. and South.

MERGUI HARBOUR (*Lat. 12° 26′ N., Long. 98° 36′ E.*).—Madramakan island situated in the south-east corner of the shallow area between Kala and Mergui islands, is nearly 2 miles long in a north-north-west and opposite direction, and 9 cables wide; Patawtaung hill, 785 feet high and crowned by a pagoda, is near its northern end, and at its south point is Patitaung, 264 feet high, also having a pagoda on its summit.

The eastern side of Madramakan island with the western coast of Mergui island forms Mergui harbour, which, although half a mile in length in a north and south direction and 3 cables in width, is much reduced by low and shelving rocks extending about 1¼ cables from Madramakan island, and detached heads, one of which dries 3½ feet at low water, spring tides; on the eastern side, a shoal spit, with depths of from 2¼ to 3 fathoms over it, nearly divides the anchorage, stretching about half way across the harbour, and shoal water extends from Mergui island on the southern side of the anchorage.

Entrance (*Lat. 12° 30′ N., Long. 98° 36′ E.*).—The entrance to Mergui harbour is on the eastern side of the shoal area already mentioned, and about 2 cables westward of the light beacon, thence the channel, with a south-south-east and south direction, is from 1½ to 2½ cables from the west coast of Mergui island.

Depths.—The least depth in the entrance is 2¼ fathoms, and about 1½ fathoms in the channel, and there are from 3¼ to 5¼ fathoms at the anchorage.

Beacons.—A beacon, painted white, surmounted by a white ball over a diamond, painted black and white, is situated on the coast about 1½ miles southward of Kalwin point.

A beacon, similar in every respect, on a hill north-eastward of the town, about 100 feet high, is situated nearly 8$\frac{8}{10}$ cables S. 23° E. from the preceding, and these in line lead through the entrance of the channel to the anchorage.

Inner anchorage.—The anchorage off Mergui town is nearly divided by the shoal spit already mentioned, leaving an area about one cable by two cables in extent on its north side, in which the anchorage, with from 3¼ to 4¼ fathoms water, is with the wharf bearing about E.S.E.; the southern area, about 2 cables square, has

Plan 218, Mergui harbour. Var. 0° 50′ E.

depths of from 3¾ to 5¼ fathoms, with the wharf bearing E.N.E., in each case distant about 1½ cables.

Chart 1075, Approaches to Mergui harbour.

Directions.—Approaching Mergui harbour from the northward, Kings, Plantain, and Thamihla islands show as one lofty island, and from a position midway between Thamihla and Kawdwé islands steer S. by E. ¼ E. for the eastern extreme of Plantain island, which is steep, and when Thitya islet bears E.S.E. steer S.S.E. ¾ E. for Patawtaung hill.

When the north-east extreme of Plantain island bears N.W. ⅜ W., and is almost touching the south-western extreme of Thamihla island, alter course to S.E. ⅜ E., keeping this mark on astern, which leads direct to the anchorage at from one mile to 1½ miles north-westward of Kalwin point.

Plan 218.

For Mergui harbour.—Without local knowledge the channel to Mergui should not be entered by a vessel of 10 feet draught until after the first quarter flood, or till after half flood if drawing more than 10 feet; with local knowledge, and at neap tides, a vessel of 15 feet draught may enter after the first quarter flood.

From the anchorage steer for the light beacon north-westward of Kalwin point, and when the beacon, about 1½ miles southward of Kalwin point, is in line with the beacon (both white, surmounted by a white ball over a black and white diamond shape) on a hill about 100 feet high north-eastward of the town, bearing S. 23° E., steer for them until the eastern end of the Deputy Commissioner's house is in line with the western end of the market, a conspicuous white shed near the water, bearing S. 8° E.

Continue on this mark until the northern end of Madramakan island bears W. by N. ½ N., when alter course to S. ¼ W., with the western extreme of the trees on Kalwin point astern bearing N. ¼ E., which leads from 2 to 2¼ cables off Mergui island, and by steering to pass about 2½ cables westward of the end of the main wharf, to the anchorage as directed.

Tides.—It is high water, full and change, at Mergui at 10h. 29m.; springs rise 18 feet 1 inch, and neaps 11 feet 2 inches; neaps range 4 feet 5 inches.

Tidal streams.—The rate of the tidal streams at half tide, at springs, is about 2 knots during the dry season; the rate of the ebb is probably more during the rains. The flood stream sets southward, the ebb northward.

Mergui (*Lat. 12° 27′ N., Long. 98° 36′ E.*), the most important town in the southern province of Burma, and the head-quarters of

Plan 218, Mergui harbour. Var. 0° 50′ E.

a Deputy Commissioner, is on the western side of Mergui island, which is separated from the mainland by the Tenasserim river and one of its numerous creeks.

It stretches for more than a mile along a muddy shore, over a small ridge, and down its farther side, and has wooden houses, thatched with palm leaves. Bungalows on the hills, surrounded by trees and flowers, and its white pagodas give it a picturesque and pleasing appearance from the anchorage; its population, which is increasing, was 11,987 in 1901.

Communication.—The British India S.N. Company have a service of steamers weekly calling at Rangoon, Tavoy river, and Puket, and fortnightly with Moulmein, Yé, Tavoy, Bokpyin, Pakchan river, and Penang; there is also telegraphic communication.

Supplies of fresh meat, bread, and vegetables may be procured, and water of fairly good quality is put on board by the B. I. S. N. Company's tank boat.

Hospital.—There is a hospital into which seamen are admitted, an entrance fee being paid by the master of the vessel.

Storm signals are shown at Mergui. *See* pages 74-76.

Trade.—The chief exports are fish paste, mother of pearl shell, and timber, and the imports cotton piece goods, husked rice. The pearl fisheries of the island constitute a considerable portion of trade, the pearls being noted for colour and lustre.

Climate.—The climate, though warm and humid, is considered healthy. *See* Meteorological table, Appendix, page 584.

Chart 1075, Approaches to Mergui harbour.

SOUTHERN APPROACH TO MERGUI.—The islands in the southern approach to Mergui harbour are:—

Northern side.—Burnett (Tada) island, half a mile south-eastward of the southern end of Kings island, is about 3¼ miles long in a north and south direction, of irregular width, and low.

Shrub rocks, 23 feet high, lie on the south-east extreme of a shoal which extends nearly one mile in a north-west direction, and are nearly 1¾ miles west-south-west of the south point of Burnett island.

Pyin (Thamihla) island (*Lat. 12° 20′ N., Long. 98° 26′ E.*), 1¾ miles north-eastward of the north-east point of Burnett island, is about half a mile in extent, 293 feet high, and stands on a mud flat joining Burnett and Bertie islands.

Bertie (Ma-ing) island, about one mile north-eastward of Pyin island, is about 3 miles in length and the same in width, and

General charts 216a, 830, 70.

Chart 1075, Approaches to Mergui harbour. Var. 0° 50′ E.

all covered with low mangroves, except a wooded hill about 200 feet high at its south-east point; a point of the mud bank mentioned extends about 1¼ miles eastward of the island.

Limlor (Arabann) island, about 6 cables long in a north-east and south-west direction, 2 cables broad, and 204 feet high, is on the south-eastern corner of the mud flat of Bertie island, and opposite the entrance to Kwan Thaung Wa channel leading into the southern entrance of Tenasserim river. There is good anchorage in depths of from 7 to 8 fathoms immediately southward of this island.

Thitya island, separated from Bertie island by a narrow channel, is triangular in shape, about 1½ miles in length in a north-east and south-west direction, and nearly one mile wide at its broadest end; it is bordered by mangroves, but has hills about 60 feet high at its north-east end.

Southern side.—North Round island, half a mile southward of the southern end of Burnett island, is about 3 cables in length in a north and south direction, one cable wide, and 243 feet high; a shoal with 2¾ fathoms water over it lies about a mile north-east, and a rock, drying 9 feet, lies 1¼ miles eastward of North Round island.

South Round island, half a mile further southward, is 136 feet high, and rather smaller. The bottom appears to be foul between these islands and Merghi islands, to the southward.

Chart 216a, Mergui archipelago.

Merghi islands, southward of Burnett island, are two in number, bold and lofty; the highest summit, 1,646 feet high and pyramidal, is on the south-western island. A shelving mud bank, with only 3 fathoms over it at 1¾ miles from the southern islands, extends westward of them.

Chart 1075, Approaches to Mergui harbour.

Thetyagi islet is about 2⅔ miles east-north-east of North Round island. Two islets or rocks, the northern of which is 80 feet high, lie three-quarters of a mile northward of Thetyagi islet, on the same bank, which dries.

Balu (Thetyangai) islet (*Lat. 12° 18′ N., Long. 98° 28′ E.*) is 341 feet high and has a small summit at its south-western end; the mud dries all round, and a mile westward of, this islet at low water.

Letsari islets, 3¾ miles north-eastward of Balu island and eastward of Bertie island, are two in number, three-quarters of a mile apart in a north-east and south-west direction; the southern islet,

Chart 1075, Approaches to Mergui harbour. Var. 0° 50′ E.

which is on the northern end of a large mud bank, is 195 feet high, the northern, in the middle of the channel northward of the bank, 82 feet; and both are thickly wooded.

The mud flat extends southward from South Letsari islet to within 2 cables of Falle islet, which is the northern of several haycock-shaped islets. This mud flat forms the eastern boundary of the southern entrance into Mergui and the northern boundary of what appears to be a fairly deep channel into Tenasserim river.

Entrance.—Depths (*Lat. 12° 30′ N., Long. 98° 36′ E.*).—The southern entrance to Mergui harbour is between Shrub rocks and Burnett island on the north, and North Round island on the south, side, and between the two latter it is about 3 cables in width; this route saves a detour of about 15 miles to vessels of light draught coming from the southward.

The depths, from 12 to 20 fathoms at the entrance, at 2 miles within shoal to 3½ fathoms, above Limlor island to 1½ fathoms, and above the southern Letsari island to half a fathom, and in some parts of the channel there is only one foot or 2 feet at low water, spring tides; vessels of 8 feet draught can use it at high water.

Directions.—Cantor (La-e-Kabyatt) island is situated 7 miles south-westward of the southern end of Kings island, on the northern side of the entrance, and when its south end bears N.W., distant 2 miles, steer N.E. ¼ E. with the southern end of Burnett island on the starboard bow, and when 1¼ miles distant from Shrub rock alter course to pass midway between the southern end of Burnett island and North Round island, remembering that the tidal streams at springs are strong. *See* pecked line on 1075.

From the southern end of Burnett island steer N.E. ¾ N. for about 3½ miles, or until the eastern extreme of Pyin island bears N. by E., when alter course to E.N.E. and pass 2 cables southward of Limlor island; continue on the same course until the southern extreme of this island bears West, then steer about N.E. ¾ N. with Patawtaung, the highest land in this direction, nearly ahead. This channel is marked by fish traps on either hand, and the fairway is midway between them.

Above North Letsari islet, the mud flats extending off the southern side of the entrance to Kan-bi-sat creek, on the east, and Thitya island, on the west, nearly join, and the channel between them is divided by a bank which dries 2 feet, leaving narrow channels on each side, in which there is a depth of 12 feet at high water neaps, the fishing stakes showing the sides of the channels; the eastern channel may be the better of the two as the mud flat on that side has more water over it than that off Thitya island.

General charts 824, 216a, 830, 70.

Chart 1075, Approaches to Mergui harbour. Var. 0° 50′ E.

When Kan-bi-sat creek entrance bears East, steer about N.N.W. ¼ W. until just past the fish trap on the eastern side of the channel and 2 miles south-south-eastward of Kalé island, then steer about N.E. by E. for the northern end of Madramakan island, passing between the fish trap and Greenwich reef, a patch of rocks that dries at half tide, lying nearly 1¾ miles southward of Kalé island.

When past the sand spit and the southern point of Madramakan island bears E. by S. ¼ S., steer towards that point, rounding it at a distance of 1½ cables, and thence for the anchorage off the main wharf. *See* page 526.

Chart 830, Bassein river to Pulo Penang.

Tenasserim village (*Lat. 12° 3′ N., Long. 99° 0′ E.*), situated on low ground at the confluence of the Great and Little Tenasserim rivers and 33 miles south-eastward of Mergui, is built along the slopes of a hill, in mountainous country, on the site of the ancient city which was for several hundred years the principal port of Siam. The Court house stands on a height above the village, and on the same hill are two ancient pagodas; the village barely contains a hundred houses.

A few miles below the village a reef of rock stretches across the river, which, even during the rains, is impassable by a vessel drawing more than 6 feet. The temperature is variable, and the climate unhealthy.

Chart 1075, Approaches to Mergui harbour.

TENASSERIM RIVER has several mouths, the two principal of which are separated by Mergui island; the banks of the river are in places very steep, and the channel is in parts narrow, but large boats can ascend as far as Tenasserim village, the river being tidal for 10 miles above this.

FELL PASSAGE (*Lat. 12° 33′ N., Long. 98° 29′ E.*), on the eastern side of Kings island, and used by vessels proceeding through the archipelago, is 19 miles in length, the channel being narrow and running through the mud banks that lie between all the islands, but with a rising tide it is by no means difficult.

Northern entrance.—Depths.—Sa islet, about half a mile off the eastern side of Plantain island, has been already mentioned (page 525); it is 322 feet high, about half a cable in extent, and, with a smaller islet off its northern side, forms the western entrance point to Fell passage.

The eastern side is formed by the point of a stony shoal, with from 1¼ to 2¾ fathoms water over it, which extends nearly 2½ miles north-

north-west of the north point of Kala island, and the width of the channel between these is about 3 cables.

The depth at the entrance is 4½ fathoms, decreasing to from 3¼ to 4 fathoms within, which depths are continued for about 6¾ miles to the north extreme of Yemyok island, after which the least depth is 2¼ fathoms, but about midway through the channel and between Pigalé and Thanpo islands there is a patch of 1½ fathoms, difficult to avoid; at high water, neap tides, the depth is not less than 3½ fathoms in the passage.

Directions.—Approach Sa islet with its eastern end bearing S.S.W. to a distance of 2 cables, pass the same distance eastward of the islet, and then steer S. by W. ¼ W. On approaching the north-western elbow of Kala island keep rather over to that side until the channel between Yemyok and Kings islands opens, when gradually haul over to the western side of the channel to clear a shoal with a depth of 1½ fathoms, the edge of which extends from the north point of Yemyok island in a north-east direction to Kala island.

Yemyok island, covered with mangroves, has a spit that dries 3 cables off its northern end, and the western shore should be kept, past a large double creek that does not dry, and until Sakoné, a small round wooded islet, 148 feet high, is open westward of Yemyok island, bearing about S. ¾ W.

From this course should be altered gradually to bring, and keep, Sakoné islet bearing S. ¼ W., and open eastward about twice its own breadth of Bare island, which has a rounded bare summit 148 feet high, and, when about half a mile southward of the latter, keep the eastern side of Bare island in line with the western side of Yemyok island, bearing about N. 25° E., as a stern mark, steering S. 25° W. until the north end of Payegyun is abeam, when keep sufficiently to the southward to open the above islands, and, passing Bare island at the distance of one cable, steer about S.S.W. ⅝ W. for Pigalé islet, which is small and 95 feet high.

There is a passage on either side of Pigalé islet, the eastern, although the narrower, being more direct, is easier when going southward, and preferable for short vessels.

Rocky spits project north-north-eastward and eastward of Pigalé islet, and when the northern end of that islet bears W. by S. ½ S. keep in mid-channel, leaving a beacon, consisting of a pole surmounted by a basket, which marks the end of the rocky spit extending eastward, to the westward, and pass along the eastern side of the bank which surrounds Thanpo island and extends southward of it at 1½ cables distance, and the north-western end of Gyunthaung at 2 cables.

Chart 1075, Approaches to Mergui harbour. Var. 0° 50′ E.

A shoal of sand and shells, with a depth of 2¾ fathoms over it, lying in mid-channel, half a mile south-westward of the western extreme of Gyunthaung, is cleared by borrowing on the western side, and the track now leads midway between Kings island, on the north, and Burnett, Fell, and Passage islands, on the south. Between the first-named the eddies at springs are strong.

Water can be procured on Kings island, northward of Fell island, but the mouth of the stream is not noticeable.

SOUTHERN ENTRANCE.—Depths (*Lat. 12° 19′ N., Long. 98° 21′ E.*).—The southern entrance to Fell passage, between the south extreme of Kings island on the north, and Passage, Fell, and Burnett islands on the south, is about 4 cables wide between the 5-fathoms contour lines. The southern end of Kings island terminates in a bay, between the headlands of which the water is shoal.

The depths in this entrance are from 10 to 16 fathoms.

Fell (Tadagyi) island is 797 feet high, and has two summits, the western being the higher.

Lah-chi islets, a group of five, lying southward of Fell island, are of conical shape from 136 to 146 feet high, except the northern islet, which is 304 feet high.

Passage (Tadángé) island, over a mile south-westward of Fell island, is 370 feet high, and has a nearly level summit with a slight saddle in the centre. A mud bank with depths of from 2½ to 3 fathoms extends about 8 cables westward of it.

Directions.—Vessels proceeding to the northward through Fell passage should reverse the directions already given until Gyunthaung island is passed, and then round the north-eastern part of Thanpo island, south-westward of Pigalé, at 1½ cables distance, to avoid a shelving gravel bank off it, and when the eastern side of Myi-ni islet (113 feet), which is next north of Thanpo island, is nearly in line with the bare summit of Bare island, bearing N. 34° E., steer N.E. by E. until the eastern side of Bare island is in line with the western side of Yemyok island, N. 25° E., when reverse the previous directions. The 1½-fathoms shoal in this channel is composed of gravel.

Tides.—In Fell passage it is high water at the same time as at Mergui. The diurnal inequality is large, the tide lagging at neaps for 2 hours and gradually lessening to half an hour towards springs.

Tidal streams.—The flood tidal stream enters the passage at both ends, meeting at about a mile northward of Bare island. Between Passage and Christmas islands, 20 miles south-westward,

Chart 1075, Approaches to Mergui harbour. Var. 0° 50′ E.

the general set of the flood stream is easterly. In the vicinity of Shrub rocks, the indraught of the flood to the eastward is very strong at springs.

Charts 1075 and 216a, Mergui archipelago.

BENTINCK ROUTE.—This route, shown by a pecked line on Charts 1075, 216a, is from the southern entrance to Fell passage, and crossing the mud bank extending westward of Passage island, joins the track of the southern route to Mergui harbour.

Pass half a mile north-westward of Passage island, and bring the south-western point of Kings island in line with the sharp peak of Maingy island, bearing N. 21° W., steering S. 21° E. with this mark on astern, and when Shrub rocks, 23 feet high, bear N.E., steer S.W. ¼ W. until the southern extreme of Cantor island bears N.W. about 1¾ miles distant, when alter course to S.W. ⅜ S. to pass about a mile north-westward of Christmas island.

The double peak on the southern end of Ross island, kept well open of the southern extreme of Cantor island, bearing S. 67° W., leads southward of the shoals extending eastward of the latter. Small vessels cross the banks by keeping the eastern side of Passage island open of Fell island, N. 33° E.

Between Cantor island and Hext rock guard against being set to the southward.

See page 535 for continuation of directions.

Polly (La-é) island, westward of the southern part of Kings island, is 2½ miles long in a north and south direction, and has a conspicuous peak 727 feet high.

Bound island, 4 miles west-south-westward of Passage island is 203 feet high and rounded. Mouse islet, small, conical, and 173 feet high, lies one mile westward, and Lump rock, 20 feet high, 1½ miles south-westward of Bound island.

Medina patches, one mile eastward of Bound island, are 1¼ miles in length in a north-west and south-east direction, and have a least depth of 1½ fathoms, over gravel, at low water; they lie on a bank with depths of 3¼ to 5 fathoms, over sand and mud.

Cantor (La-e-Kabyatt) island, 359 feet high and irregular, is 1½ miles long in a north and south direction; a rock with 6 feet over it at low water, spring tides, lies $1\frac{3}{10}$ miles east-north-east of its southern point, and there is foul ground between the rock and the island.

Chart 216a, Mergui archipelago.

Hext rock (*Lat. 12° 8′ N., Long. 98° 16′ E.*), $4\frac{3}{10}$ miles southward of the southern end of Cantor island, is 2½ cables in extent, has

Chart 216a, Mergui archipelago. Var. 0° 40′ E.

1½ feet over it at low water, spring tides, and is generally indicated by a ripple. Polly island peak, in line with the summit of Cantor island, bearing N. 1° E., leads westward of the rock.

Ross (Doung) island is nearly 11 miles long in a north-north-west and opposite direction, and lies 7 miles westward of Cantor island; its south-eastern point rises to a double summit 806 feet high.

Water.—Very good water can be obtained at Waterfall cove, which is one mile west-south-westward of the northern end of Hel-fer island, on the eastern side of Ross island. Boats at half tide can lie close to the water, which falls into the sea.

Christmas (Myauk-kaung) island, 8 miles southward of Ross island, is the north-westernmost of three islets and several rocky patches; its summit is 466 feet high, and the islet may be passed on its western side at a distance of half a mile. Eastward and south-eastward of the islets are several shoal patches.

Single rock, 10 feet above water, lies 2¾ miles north-eastward of Christmas island; in this vicinity the flood tidal stream must be guarded against at night.

Tides.—It is high water, full and change, at Christmas island at 10h. 44m.; springs rise 16 feet, neaps 9½ feet.

COASTS.—The coast to the southward of Mergui, is low and swampy in places, and several rivers, navigable only by boats, flow into the sea through narrow channels bounded by flats. The higher ridges or hummocks, many of which appear to have been islands now united by the soil brought down by the rivers, are generally covered with large trees.

Auckland bay (*Lat. 12° 5′ N., Long. 98° 35′ E.*).—The northern end of Sellore or Thalo taung tan (Yengan) island is 2¾ miles south-eastward of the southern Merghi island, and the northern part of Sellore island, with the land to the eastward and Pa Wut island to the northward, forms Auckland bay, which is well sheltered, with anchorage in depths of from 4 to 12 fathoms, over mud. Auckland bay has not been surveyed, and in entering it caution is necessary.

DIRECTIONS.—Christmas island to Forrest strait.—Except in the vicinity of West Passage island, eastward of the northern end of Bentinck island, there is, so far as is known, deep water between Christmas island and Forrest strait, but as the channels have been only partially examined caution is necessary, and the lead should be used.

General charts 830, 70.

Chart 216a, Mergui archipelago. Var. 0° 40′ E.

From one mile westward of Christmas island steer S. ⅜ E. to pass between Cap and Feathers rock and West Passage island, which course leads nearly midway between Warning rock and a reef which covers at low water, neap tides, and lies 5½ miles south-south-east of Christmas island; in shaping this course, the tidal streams, which here set north-east and south-west, must be allowed for, the lead being of little use owing to the depth.

In the vicinity of West Passage island and southward of a sunken rock, the position of which is about a mile northward of the island, but is doubtful, the deepest water is near the island. Pass three-quarters of a mile eastward of South Passage island, and one mile eastward of Bluff point, the south-eastern point of Bentinck island. *See* pecked line on 216a.

Bring Bluff point in line with the western end of South Passage island, bearing N. 2° E., and steer S. 2° W. with this mark astern, passing one mile westward of Fly rock, until Fly islet bears East, when steer midway between the rocks off Five Sisters group and Cone islet off Bushby island, and, having passed the latter, shape a S.S.E. ½ E. course to pass 4 miles eastward of Father and Son, and about 2 miles westward of High island. The tidal streams near Bushby island are strong, and must be allowed for.

South Passage island (*Lat. 11° 46′ N., Long. 98° 7′ E.*) not being easily distinguished from the southward, Father and Son well open westward of Cone islet off Bushby, bearing S. 2° E., or Cone islet open westward of Bushby island, S. 1° E., leads westward of Fly rock.

For islands and rocks around Bentinck island, *see* page 539.

Anchorages.—During the dark rainy nights which occur in the South-west monsoon, there is anchorage for a steam vessel in depths of from 6 to 8 fathoms, at about 2 miles to the eastward of Bentinck island, and midway between South and West Passage islands. There is also anchorage in Forrest strait to the eastward of Sullivan island and south-south-westward of High island, in depths of from 7 to 8 fathoms.

THE OUTER OR WESTERN ISLANDS of Mergui archipelago extend about 60 miles southward and south-south-westward from Tenasserim island (*see* page 522), and they are generally similar in appearance, high, steep, and covered with dense foliage.

Neither the islands nor the channels between them have been surveyed, and unknown rocks and reefs may exist.

Blundell island, about 2¾ miles in length in a north and south direction, is situated nearly 5 miles south-south-west of Tenasserim island, and with Chevallier island and an islet westward of its south point, and Lion rock, 1½ miles southward of it, forms the north side of Mermaid passage.

Elphinstone island, about 12 miles long in a north-east and opposite direction, and 6 miles wide, is about 7½ miles south-west of Blundell island, with Saddle island, about 190 feet high, between.

Port Maria, an inlet on the north side of Elphinstone island, extends for about 5 miles in a south-west direction, with a width of about 1½ miles; it has some islets on its western side and at its head, and affords anchorage about half a mile north-eastward of the latter, in depths of from 7 to 7½ fathoms.

Sir Charles Metcalfe island, about 3 miles in length in a north-east and opposite direction, and 1,350 feet high, is about 7½ miles south-south-west of Blundell island, and Smart island, about 880 feet high, is between it and the east end of Elphinstone island.

Mermaid passage, 6 miles in width between Lion rock and the north end of Sir Charles Metcalfe island, has charted depths of 40 fathoms.

West and East Spur, and several rocks, are situated about a mile southward of Sir Charles Metcalfe island, with Brunette and Greenlaw islands eastward of them; these latter islands are about 890 and 530 feet high, respectively.

Bailey island, 1,163 feet high, and 7½ miles south-south-west of Sir Charles Metcalfe island, is about 2 miles in extent.

Hattrass passage, between West and East Spur and Bailey island, is about 6 miles in breadth, and has depths of from 31 to 35 fathoms charted on its northern side.

H. Prinsep and Sargent islands.—Tower rock, 25 miles west-south-west of Ross island, on the north point of H. Prinsep island, is an excellent landmark. Sargent island is about 1,200 feet high, and higher than H. Prinsep island, and lies about a mile south-eastward of it.

Sir John Hayes island (*Lat. 11° 52′ N., Long. 97° 39′ E.*), about 7 miles southward of Sargent island, is 1,596 feet high, and Fletcher island, 840 feet high, is about a mile southward of its southern end.

Great Western Torres islands is the western group of Mergui archipelago, the two largest, 1,378 and 1,413 feet high, being separated by a channel, which is one cable broad at its south-eastern end, and about 6 cables across at its north-western, with general depths of 15 to 22 fathoms, but at its narrowest part, where the fringing reef on either shore reduces the passage to about 50 yards, it shoals to 7 fathoms, over coral and sand.

Half way through the channel a deep cove, the sides of which are fringed by coral, extends about 3 cables into the south-western island, with depths decreasing from 12 fathoms off its entrance to 7 fathoms near the head, which is filled with sand.

Anchorage for vessels, of too great length to moor in the cove, may be obtained in depths of from 15 to 18 fathoms off the entrance, but the holding ground is indifferent, and the position open to the swell; a short vessel requiring repair or fresh water can moor inside.

Directions.—Enter the north-west end of the channel between the islands, and with N.E. Little Torres islet showing through the south-east entrance, bearing S. 50° E., and when the cove opens anchor as convenient.

Tides.—It is high water, full and change, in this cove at 10h. 20m. approximate.

Little Torres islands are a group of four islets, the N.E. islet is 228, and the highest 304 feet high; the second islet from the southward appears double, and has a needle-shaped rock off it. The positions of the three southern islets are doubtful, and they should not be approached within 3 miles.

NEARCHUS PASSAGE is between Great Western Torres and Fletcher islands, and the following is the track recommended to Christmas island:—

From 2 miles northward of Great Western Torres islands steer to pass 1½ miles southward of Fletcher island, and then about E.N.E., passing 2 miles southward of Courts island, the summit of which, from this direction, appears as a volcanic cone, but the peak on the northern part of Bentinck island is not conspicuous. From the southward of Courts island steer about N.E. ½ E. for Christmas island, passing 3 miles north-westward of Warning rock.

Nearchus rock, covered at high water, is situated 13 miles east-south-east of Fletcher island, and 8½ miles from the west coast of Bentinck island; at about 1½ miles around it are depths of from 31 to 35 fathoms.

Black rock (*Lat. 11° 23′ N., Long. 97° 39′ E.*), which is isolated and visible from a distance of 8 miles, lies about 15½ miles south-eastward of the southern Little Torres island.

BENTINCK ISLAND (Bazangu), 15 miles in length in a north-north-west and south-south-east direction, about 4½ miles in greatest width, and of irregular shape, is hilly, with several high summits, the most conspicuous, 1,012 feet high, being near its northern end; it appears like a horn on north-easterly or south-westerly bearings.

The north-eastern arm of Bentinck island is really a separate island, having a narrow channel, with a depth of about 2 fathoms, separating it from the main island and leading through into the northern bay, which has been only partly examined. The west coast of the island is steep and iron bound, with several islets off it; but on the east coast, which is much indented, there is smooth water and good anchorage, especially between the Passage islands.

Daphne rock, awash at low water, lies about half a mile off the east coast at 4½ miles northward of Bluff point, the south-eastern extreme of the island.

Several rocks, one of which is perforated, lie off the southern end of Bentinck island; the southern rock is about 10 feet high and lies 2½ miles south-westward of Bluff point.

West Passage island, bold, wooded, and situated about 2 miles eastward of the north-eastern part of Bentinck island, is 445 feet high, and steep-to on its eastern, but foul on its western, side; it marks the western side of the channel leading southward from Christmas island.

Warning rock (*Lat. 11° 54′ N., Long. 98° 5′ E.*) dries at half tide, and lies 4¾ miles north-north-west of the eastern point of West Passage island.

Rock.—A rock, 15 feet high, lies 3½ miles north-westward of the eastern point of West Passage island.

Peterson rock dries 6 feet at low water, spring tides, and is situated 1½ miles west-north-west of the eastern point of West Passage island.

Rock.—A sunken rock has been reported to lie about one mile northward of the eastern end of West Passage island, but its position is doubtful.

Elephant island, 2 miles eastward of West Passage island, and 141 feet high, appears flat topped from a distance, but is really of very peculiar shape; it marks the eastern side of the channel abreast West Passage island.

Cap and Feathers, a single rock, 34 feet high, lies half a mile north-westward of Elephant island, and must be given a berth of at least 3 cables.

The general depths in the channel between West Passage and Elephant islands are from 3 to 3½ fathoms.

South Passage island, about 3¼ miles southward of West Passage island, is 364 feet high, bold, and wooded.

Chart 216a, Mergui archipelago. Var. 0° 40′ E.

DOMAL ISLAND (Tazindana), the centre of its west coast 6 miles eastward of Bluff point of Bentinck island, is 23 miles in length in a north-north-east and south-south-west direction, with an average breadth of 4 miles; it is mountainous, the summit, nearly in the centre of the island, being about 2,230 feet high. Off the northern end, extending in a northerly direction, are Money, Trotter, and Parker islands, besides numerous small islets and rocks.

High Peaked island, westward of the south-western point of Domal island, is 956 feet high, and appears of conical shape from the northward and north-westward. Off the northern end of High Peaked island is Second Observation islet, 272 feet high, and cliffy, and two rocks, the northern of which, 44 feet high, is named Fly islet.

Fly rock (*Lat. 11° 29′ N., Long. 98° 6′ E.*), 2¼ miles north-westward of Fly islet, is a pinnacle of rock covered with coral, awash at low water, spring tides, and only a few yards in extent; it is steep-to on all sides, and cannot be seen at ordinary low water.

Bushby (Buza) island is bold, with many wooded summits, 400 to 1,028 feet high, and abounds with wild pigs. Its north coast is indented, and there is a village on the shore of one of its bays. Cone islet, 200 feet high, lies a mile off its western coast.

Anchorage in a depth of 8 fathoms may be obtained just outside a line joining the points of a small sandy cove at the north-west point of the island, and here there is a good watering place.

Five Sisters is a group consisting of five small islands and about fifteen rocks of various sizes, mostly bare and probably uninhabited. Some of the rocks and dangers on the eastern side of the group are not easily seen at night, one of them being a reef only 10 feet high.

A group of rocks above water, one of which is 50 feet high, lies about 2½ miles south-south-east of Charlotte island, the southern of the Five Sisters.

Kisseraing (Kitthareng) island, eastward of Domal island, is 18 miles long in a north and south direction, 10 miles broad, and considered one of the most fertile of the Mergui archipelago. Celerity passage, between it and Domal island, is narrow, with 1¼ fathoms water in it; the channel on its eastern side is almost dry at low water.

Whale bay, between the south-eastern side of Kisseraing island and the mainland, is a spacious anchorage, the approach to which is from the south-west. There is believed to be anchorage in depths of from 6 to 8 fathoms in the eastern part of Whale bay, but the bay and all its vicinity have been only partially examined, and should be navigated with caution. There is a police station at Cheding on the south-eastern side of the bay.

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Chart 216a, Mergui archipelago. Var. 0° 40′ E.

COAST.—Lenya river, the entrance to which is in the north-eastern part of Whale bay, rises close to Pakchan river, and flows roughly from south to north; at Lenya village, about 36 miles from the entrance, the river is not more than a cable in width, and is navigable for small coasting steamers, the B.I.S.N. Company's steamer *Mergui* having ascended to this point.

Yengan Myit river, about 12 miles southward of Lenya river, is navigable by laden boats as far as a rocky barrier.

Bokpyin creek (*Lat. 11° 17′ N., Long. 98° 47′ E.*), about 7½ miles southward of Cheding, is dry at low water, and flows through a fertile, but thinly-peopled country. From a recent description of this part of the coast, Lower Bokpyin, on the north side of the entrance, would appear to be known as Outer Bokpyin, and Bokpyin town as Inner Bokpyin village, which latter is said to be 5 miles up the creek, and reached by medium-sized boats. The island, about 3½ miles westward of Outer Bokpyin, is named Silver island, and off it small coasting steamers stop to pick up passengers.

Communication.—The British India S.N. Company have a fortnightly service of steamers between Mergui, Bokpyin, and Karathuri.

Coast.—Karathuri is situated about 21 miles southward of Bokpyin creek, and between the coast is much intersected by creeks and streams, and backed by hills. Karathuri village is entirely inhabited by Chinese, who wash tin, and a village named Kyauk-Kyi-Chaungwhese (not charted), to the northward of Karathuri, is similarly inhabited.

Chauntanaung village, about 4 miles southward of Karathuri, is deserted.

Son and Father, two barren rocky islets, 335 feet and 596 feet high respectively, lie close together in a north and south direction from each other; Son islet is situated 7½ miles south-south-east of Charlotte island, the southern of the Five Sisters. Rocks above water lie about a mile north-north-westward of Son islet.

Forrest passage, between Father islet and Sullivan's island, is nearly 13 miles wide. The flood tidal stream sets eastward and the ebb westward at a rate of about 2½ knots at springs.

Clara (Awi) island, westward of Sullivan's island, is about 6¾ miles in extent in a north-east and south-west direction, and tapers to a point at its south-west end; it has two peaks, the northern and higher of which is 1,753 feet high, and the southern peak is sharp.

North Sentinel islet, with a rock on its western side, lies about 1½ miles north-eastward of the north-eastern point of Clara island.

South Sentinel islet is high, and lies about a mile southward of the south-west point of Clara island.

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Chart 216a, Mergui archipelago. Var. 0° 40′ E.

FORREST STRAIT.—High (Tsing) island, with a double peak, 1,392 feet high, lies about 5 miles east-north-eastward of the north-eastern part of Sullivan's island. Overfalls and tide rips are numerous northward of the island.

A rocky ledge dries out 2 cables from the large sandy beach on the eastern side of High island, and northward of this there is a cove where fresh water can be obtained; but a kedge is required for anchoring close in, as the depth is over 15 fathoms.

The track (*see* pecked line on 216a) lies 2 miles westward of the island, where there are overfalls and eddies probably caused by an irregular bottom, and passes through discoloured patches.

Sullivan's or Lampi island (*Lat. 10° 50′ N., Long. 98° 15′ E.*), 19 miles long in a north-north-west and south-south-east direction, with an arm extending 9 miles south-westward from its northern point, is of very irregular shape, and about 2½ miles in average width. Its northern point is about 12¾ miles south-south-eastward of Father islet.

At the north end of Sullivan's island, but close to it, are several small islands; Two Hill island, 458 feet, and Olive island, 353 feet high, with the exception of a rock with less than one fathom water over it north-west of the latter, appear to have deep water off them, but Dolphin islands, which are 3 miles further south and 169 feet to 226 feet high, with conspicuous trees upon them, have a bank extending 1¼ miles eastward of the southern island.

The Foreland, on the eastern side of Sullivan's island, and about 15 miles from its northern point, has a low white cliff on it which shows up in the morning sun. Bold promontory, 2½ miles southward of the Foreland, is not so conspicuous.

Water.—An excellent stream of fresh water flows into the sea near this anchorage at all times of the year; the watering place is known by a large white rock, which fronts it.

Half Moon reef, lying 3 miles northward of the northern extreme of the Foreland, and 1½ miles off-shore, dries 2 feet at low water, spring tides, and is about 2 cables in extent. Olive island summit open eastward of the Dolphins, bearing about N. 40° W., leads north-eastward of Half Moon reef; and Bold promontory, open eastward of the Foreland, S. 9° W., leads eastward of it.

Eyles (Naza) island, about 2 miles in extent, and 774 feet high, and Steep island, 426 feet, lie off the southern end of Sullivan's island; and 1¼ miles eastward of Steep island is Steep shoal, a narrow rocky shoal, with a depth of 5 feet over it at low water; High island summit open eastward of the Foreland, bearing N. 2° W., leads eastward of the shoal.

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Chart 216a, Mergui archipelago. Var. 0° 40′ E.

Anchorage (*Lat. 10° 48′ N., Long. 98° 15′ E.*).—A pearl bank of some extent has been reported off the western side of the island, and there are also several islands sheltering an anchorage with depths of from 4 to 6 fathoms, eastward of the southern island, but it has only been partially examined.

The Gregorys, a group of five low-level tree islands on flat rocky bases covered with sand, lie eastward and south-eastward of the southern part of Sullivan's island and in the middle of Forrest strait; the group is uninhabited, but visited by wood cutters, and the Nicobar pigeon, the flying fox, the monitor lizard, and tree crabs are found.

Crichton or Bogwo, the northernmost of the group, about 3¾ miles east-south-east of Bold promontory, is a mere wooded cay, with shoal water extending 1½ miles northward of it, and terminating in Marble patch, on which is a depth of 4 feet over coral.

Boyut, 180 feet high, the southern Gregory, has a shoal ridge extending south-westward of it, and it should not be approached from any direction within 1½ miles. Rocky ledges project from all the islands of this group, and the passages between the islands are foul.

Tides.—It is high water, full and change, at the Gregorys at 10h. 20m.; springs rise 14 feet; neaps rise 10 feet. In winter night tides are higher than day tides. In summer the mean level of the water is higher than in winter.

Tidal streams.—Near High island the flood stream sets eastward, and the ebb westward.

In the channels on either side of the Gregory group the flood sets north-north-eastward, and the ebb south-south-westward.

Kurrachee rock, nearly 2 miles east-south-east of the southern extreme of the largest Gregory island, dries 5 feet at springs; to clear it on its eastern side keep in depths of less than 10 fathoms, and the northern and larger Turret island (Kasaingla), 341 feet, bearing S. 15° E., with the smaller island shut in by it, leads eastward of the rock.

The eastern side of Forrest strait is formed by the main land of Tenasserim, which although high at some distance from the sea, is low near the shore and without any conspicuous marks; Boyce hill, 806 feet high and 1½ miles inland, being the only hill near the sea. The coast is fronted by a mud bank, with several rocks showing at low water in-shore, and off the northern end of Boyce headland are several small islets.

Canister rock, the northernmost of these islets, is 87 feet high, small, steep, and situated 12½ miles south-south-east of High island. A rock, which dries 4 feet at low water, spring tides, lies a quarter of a mile northward of Canister rock.

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Chart 216a, Mergui archipelago. Var. 0° 40′ E.

Campbell reef, a flat stony reef that covers at high water, is 2 cables long by 1½ cables wide, and lies 3¼ miles southward of Canister rock. Caution is required when proceeding southward, in the vicinity of this reef, as there are depths of 6 fathoms within a mile of it.

Boyce shoal, said to have a depth of 2 fathoms over it at low water, with 4 to 8 fathoms around, and to lie about 2¾ miles south-eastward of Crichton island, was not found when the strait was surveyed in 1886; its existence is doubtful.

Directions.—Forrest strait is used by all steamers and native vessels trading through the archipelago, there being plenty of water and good shelter from westerly winds. In navigating the strait it is advisable to take bearings to summits, and not to extremes of land which may be affected by distance, mirage, and new growth of foliage. Although the strait (in the track recommended) is navigated by night with local knowledge, a stranger should not do so, owing to the difficulty of the channel between Marble patch and Campbell reef.

Continue the S.S.E. ½ E. course, which was shaped between Bushby island and the Five Sisters (*see* page 536), allowing for set, to a position 3½ miles south-westward of Canister rock, and then steer S. by E. ⅜ E. for Turret island, a bold precipitous rock 341 feet high, which appears in clear weather to stand out from the land like a square block, which course leads in mid-channel between the Gregory group and the mainland, the depths gradually shoaling to 5 and 3½ fathoms at low water.

The narrowest part of this channel is between the rocks off Red point (which is not red) and Kurrachee rock, where it is about 4 miles wide. When the southern end of the largest Gregory island bears W. by N. ¾ N. steer S.S.W. for 4½ miles into deep water, and then S. ⅜ E. to pass from 2 to 3 miles eastward of the Five islands, when steer about S. by W. ⅛ W. to clear the extensive sand and mud flat lying off Pakchan river entrance.

The channel westward of the Gregory group, although deeper, has irregular soundings, and is impracticable by night; it is not recommended.

Anchorage is good anywhere between High island and Turret island.

OUTER ISLANDS. — North and South Twin (*Lat. 10° 38′ N., Long. 97° 42′ E.*), the westernmost of the islands of this part of Mergui archipelago, are of small dimensions, and have not been examined.

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Chart 216a, Mergui archipelago. Var. 0° 40′ E.

Great Swinton islands, close together stretch about 7 miles in an east-north-east and west-south-west direction, the western island being nearly 20 miles south from the southern peak of Clara island. The following small islets lie north-north-eastward of the westernmost of the Great Swinton islands:—Islet with a rock westward of it at 4 miles, Red islet at 10 miles, Brown islet at 13½ miles, and Ninepins rocks at 16 miles, the latter rocks being 3 miles southward of the islets off the southern point of Blunt island.

Loughborough passage, between Great Swinton islands and Loughborough (Salan) island, is about 2¼ miles wide, and on the north-eastern side of Loughborough island and about three-quarters of a mile off-shore, a few soundings of 17 to 19 fathoms, over clay, have been obtained. Hayward island, with rocks extending north-eastward of it, lies about half a mile north-eastward of the eastern point of Loughborough island.

Anchorage.—There is good anchorage between Loughborough island and Richards island, eastward of it, in depths of from 8 to 15 fathoms, over mud, with 3 fathoms close to either shore.

Pollock reef (*Lat. 10° 30′ N., Long. 97° 58′ E.*).—A rock above water, and Pollock reef, a sunken reef, lie in mid-channel between Loughborough and Great Swinton islands, Pollock reef being about 2¾ miles off the north-east side of the former island, and almost exactly in mid-channel. The passage between Loughborough and Great Swinton islands should therefore not be used for navigation.

O'Connor, Saul, and Skinner islands, lying from one mile to 2 miles eastward of Richards island, are of irregular form, each being about half a mile in diameter, and it is said that there are outlying rocks around them. If passing between them and Richards island keep nearer to Richards island.

Chart 216b, Mergui archipelago.

Cavern (Tai naine) island.—Several islands lie south-eastward of Loughborough island, the largest being Cavern island, on the southern part of which are several caverns where edible nests of the swift are procurable; it is distant about 5 miles from Loughborough island. The central part of Cavern island is reported to be very narrow.

ST. MATTHEW'S ISLAND, the north-east extreme of which is about 15 miles from Point Victoria on the north side of the entrance to Pakchan river, is 16 miles in length in a north-east and south-west direction, 6 miles in greatest breadth, and nearly 3,000 feet high in its central part. Tracks of large animals and elk

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Chart 216b, Mergui Archipelago. Var. 0° 40′ E.

have been seen on the shore of Hastings harbour, and wild hogs and pigeons are plentiful, but the jungle is dense; some fine straight timber grows here, and fresh water may be obtained, except in unusually dry seasons.

Plan 91, Hastings harbour.

Russell island (*Lat. 10° 15′ N., Long. 98° 15′ E.*), the centre of which lies about 11¼ miles north-eastward of the northern point of St. Matthew's island, should not be approached, as sunken rocks are said to exist north-westward and southward of it. The channel between Russell and St. Luke's islands appear to be navigable, but rocks are charted on its northern side.

Hastings harbour, formed by St. Luke's and Hastings islands and the north coast of St. Matthew's island, is about 5 miles in extent, and affords excellent and sheltered anchorage; it has two entrances, one north-westward of Hastings island, the other south-westward of it.

A rocky patch, dry at low water, spring tides, with 9 to 10 fathoms close to, lies on the northern side of the southern entrance, one mile east-south-east of South point, Hastings island; and a rock, about 40 yards in extent, with 2 fathoms least water over it, and 7 fathoms close-to, lies 9 cables south-south-west of the same point.

There are no known rocks in the northern entrance, but several islands lie in its approach, with apparently deep water between them; caution is necessary in the vicinity as it has not been surveyed, and the water is sometimes muddy when shoals are not seen from aloft.

Anchorage.—Two anchorages are charted; one in a depth of about 11 fathoms in the northern entrance, with North-west point of Hastings island bearing E. by N. ¼ N., distant 1$\frac{4}{10}$ miles; the other in the southern part of the harbour, in about 6½ fathoms water, with South point of Hastings island bearing E. ⅛ S., distant about 2¾ miles; the bottom in the harbour is mud.

Tides.—It is high water, full and change, in Hastings harbour, at 10h. 40m.; springs rise 14 feet. The rate of the tidal streams at springs is about one knot an hour.

Fish harbour, a bight in the north-eastern side of St. Matthew's island, and about 1½ miles southward of the southern entrance to Hastings harbour, is available for vessels of about 9 feet draught. A small white rock or islet, with deep water around, lies about one mile off the entrance.

Chart 216b, Mergui archipelago.

OUTLYING ISLANDS.—**St. Andrew's group,** situated between 9 and 21 miles north-westward of St. Matthew's island, are numerous, with six principal islands named after the letters A to F.

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Chart 216b, Mergui archipelago. Var. 0° 40′ E.

Horsburgh or E island, the north-westernmost of this group, and about 20 miles north-west of St. Matthew's island, is visible from a distance of about 20 miles.

Cockburn islets, three in number, and lying in nearly a north and south direction, are situated about 5¼ miles eastward of Horsburgh island.

Parsons rock, a compact group of pinnacles drying 3 to 4 feet at low water, is situated nearly 2 miles eastward of the northern Cockburn islet.

Investigator channel, which passes between Cavern island, on the north, and St. Andrew's group, on the south, has a least width of nearly 6 miles, and appears to be clear; it is a good channel for vessels from the westward bound to Hastings harbour.

Chart 830, Bassein river to Pulo Penang.

Banks (*Lat. 10° 20′ N., Long. 97° 11′ N.*).—Three banks surrounded by deep water, but of which little is known, lie westward of Investigator channel:—Heckford bank, with a depth of 7 fathoms over it, situated in lat. 10° 20′ N., long. 97° 11′ E.; Coral bank, with a depth of 11 fathoms, situated about 8 miles southward; and Roe bank, with 8 fathoms over it, 19 miles south-westward of Heckford bank.

Chart 216b, Mergui archipelago.

ALADDIN ISLANDS, south-westward of St. Matthew's island, is a scattered group, about 19 miles in length in a north-west and south-east direction, by about 15 miles in breadth; some of the islands are high and bold.

Western Rocky island, the western of the group is less than a quarter of a mile in extent, but of considerable height, being visible from a distance of about 12 miles.

North Rocky island lies about 5½ miles east-north-east of Western Rocky island.

Davis island, one of the largest of the cluster, situated 4 miles from the south-western end of St. Matthew's, is nearly 4 miles in diameter, and should be visible from a distance of about 21 miles.

Dunkin island, 2½ miles eastward of Davis island, is also high; at half a mile from its eastern side the depths are from 10 to 21 fathoms.

Haycock, an isolated rock, lies 10½ miles south-south-eastward of Western Rocky island, with depths between of from 25 to 32 fathoms.

Christie island, 9 miles south-south-westward of the south-western point of Davis island and the southern of Aladdin group, is

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of irregular form, and some rocks above and below water lie eastward and southward of its southern end.

Auriol, about 6 miles, eastward of Christie island and the south-eastern island of the group, is probably bold, there being 16 fathoms water at a short distance from its eastern side.

CHANCE ISLAND (*Lat. 9° 25′ N., Long. 97° 51′ E.*), situated 10 miles south-south-westward of Christie island, is of irregular form, 5 miles in extent in a north and south direction, and 3 miles greatest breadth; its peak is visible from a distance of about 30 miles in clear weather. There are several rocky islets in its vicinity, and some rocks above water are situated off its south-eastern side, and the island should not be approached as it has not been examined.

A rock has been reported to lie about midway between Christie and Chance islands, about 5 miles north-north-east of the latter, but its existence is doubtful.

Richelieu rock, awash at low water, is supposed to lie nearly midway between Chance island and the coast, about 12½ miles east-south-east of that island, but the position is doubtful. The rock is said to be smooth and oval in shape, about 100 feet long, and in appearance like a vessel turned bottom up.

Middle island, 18 miles south-south-west of the south point of Chance island, is 1½ miles in length in a north and south direction, and high enough to be seen from a distance of 25 miles.

Perforated island, which has a hole through it, lies 14 miles southward of Middle island. The depth at one mile eastward of it is 46 fathoms.

SAYER ISLANDS consist of nine islands, in three groups, extending in a north and south direction over a distance of 12 miles; they are densely wooded and practically steep-to. (*View A on 842.*)

North island, the northern of the group, and situated 11¼ miles south-south-west of Perforated island, is 334 feet high, and in the channel between it and Great Sayer island is a depth of 23 fathoms.

Great Sayer island or Pulo Tajah, 4 cables southward of North island, is 2 miles in length in a north and south direction, nearly one mile in greatest width, and rises at the northern part to a height of 802 feet. At the north-eastern point is a small cove, with 7 fathoms water in it.

Channel rocks, from 15 to 20 feet high, lie 5 cables south-westward of Great Sayer island, and are steep-to.

Centre islands are four in number: the northern, conical in shape and 392 feet high, is about 1¾ miles southward of Channel rocks, with depths of from 34 to 44 fathoms in the channel between; the southern island is 447 feet high, and two islets nearly connected by a reef lie off its north-eastern point, with a depth of 8 fathoms in the channel between.

Payan island, the northern of the southern group, 151 feet high, and conical in shape, lies 2¾ miles south-south-eastward of the southern Centre island.

Taku rocks, about half a mile south-eastward of Payan island, are three rocky heads which cover at high water, spring tides, and a few detached rocks, all being steep-to.

Sangasiap island, a mile south-westward of Payan island, is 428 feet high, a mile long in a north-west and south-east direction, 2½ cables broad at its south-eastern extreme, and narrows gradually to Andrew point, its north-western extreme, which is broken, cliffy, and 59 feet high.

South island (*Lat. 8° 29′ N., Long. 97° 39′ E.*), half a mile southward of Sangasiap island, has a double summit, the peaks being 385 feet and 368 feet high. The sand beach on the north-eastern side is fronted by a coral reef extending one cable off-shore. The observation spot at the eastern end of the beach is in the position given.

Tides.—It is high water, full and change, at these islands at 10h. 0m. (approximately); springs rise about 8 feet.

Tidal streams.—In the channel between Sangasiap and South island the flood stream sets eastward and the ebb westward, while outside the streams appear to set north-eastward and south-westward.

PAKCHAN RIVER rises in about lat. 10° 50′ N., Long. 99° 0′ E., and is about 80 miles in length; it is densely wooded on both sides, and numerous streams flow into it, the principal of these are Maliwun, on the British side, and Klong Bang Pra, Klong Raun, and Klong Lam Lieng on the Siamese side.

Boundary.—Pakchan river separates the territories of British Burma and Siam.

Point Victoria, the north-west entrance point to Pakchan river, and the southern extreme of the Maliwun hills, is high, bold, and steep-to.

Light.—A *white fixed* light is exhibited from a structure on Point Victoria, and should be visible, in clear weather, from a distance of 6 miles.

Approach.—Banks.—Westward of the northern entrance point to Pakchan river is the southern side of an extensive triangular-shaped bank, the western edge of which trends in a south-south-west direction from Round Woody island, situated 13½ miles northward of Point Victoria, the northern entrance point, for a distance of 17 miles, at which position the extreme of the bank is 11½ miles west-south-west of Point Victoria; most of this bank has depths of less than 3 fathoms, and there is only a quarter of a fathom near its centre, with rocks on its western edge. On the southern edge of this bank are Long, North, and other islands.

Southward of the above bank, and separated from it by a channel about 3 miles wide at its entrance, and narrowing to 2 miles when southward of the west end of Long island, is another large bank, which has not been examined, but is apparently about 1½ miles wide at its extreme, which is 11½ miles south-west of Point Victoria, from which it expands to about 4 miles, having on it Victoria, Mostyn, Festing, Dyke, and other islands.

Islands.—Long, South, and North islands.—About 3 miles westward of Point Victoria lies a group of islands, of which Long island, the largest, is about 2 miles in length in an east and west direction, high and wooded; close to its south-eastern point is South island, round and wooded; and northward of it is North island, of about the same height.

Victoria island, large, low, wooded, and somewhat triangular in shape, is one mile southward of Point Victoria, and apparently on the north-east extreme of the unexamined sandbank; its northern side is steep-to, with deep water from 2 to 3 cables distant from it.

Mostyn, Festing, and Dyke islands, south-westward of Victoria island, are low, wooded, and connected by sandbanks; they are named Goh Son by the Siamese, and are considered as one island.

Spiteful rock, a small wooded islet, 80 feet high, is situated on the southern edge of the unexamined bank, and it is reported that a very narrow bank about 1½ miles in length, with a depth of one fathom over it, exists to the south-westward of the islet, also that a rock or obstruction lies about 1¾ miles eastward; these dangers are all on the northern side of Bell passage.

LIGHT (*Lat. 9° 53′ N., Long. 98° 27′ E.*).—A *white flashing* light is exhibited, at an elevation of 90 feet above high water, from a structure on Spiteful rock, and should be visible, in clear weather, from a distance of 15 miles.

Saddle island (Goh Chang), the largest and highest of the islands along this coast, and situated southward of the unexamined bank, separated from it by Bell passage, is about 5 miles long in a north and south direction, a little over 2 miles broad, the highest peak being in the middle of the island. Large sandbanks extend from the east coast of this island, as well as from the mainland opposite; between them there is a somewhat narrow and shallow channel, difficult to find at high water, but showing at low water from the sandbank drying on both sides.

Some wooded islets lie off the south-east end of Saddle island, and a sandbank extends off its south-west coast; off the north-west side of the island is Tree islet, low, rocky, and with small trees on it, and this islet forms the eastern side of the entrance to Bell passage, the southern side of the passage within, being the north coast of Saddle island.

Harry head (*Lat. 9° 52′ N., Long. 98° 27′ E.*), the north-west point of Saddle island, is a high bluff covered with trees, and a rock is reported to be near it; from Harry head the north coast of the island, trending to the eastward, is low and covered with jungle, as is also the north-eastern point, and eastward of the latter small, low, rocky islets, only a few feet above water, are reported, terminating to the eastward in Stainer rock, which is very low, with a few bushes on it; the existence of the rocks between it and the north-east point is doubtful.

Delisle island (Goh Piam), 2 miles south-westward of Saddle island, is high, about 4½ miles long in a north-north-east and opposite direction, and 2½ miles broad; a reef of rocks with from 8 to 10 fathoms water within one mile of it, stretches along its west coast. About three-quarters of a mile south-westward of the southern point of the island is a rock which dries about 3 feet at low water, spring tides, with 7 to 8 fathoms close to.

Between this island and the mainland are large sandbanks, but there is a channel on the island side. Northward of the island, between it and Saddle island, there are depths of 5 to 7 fathoms, but there is a sandbank 4 cables north-eastward of its northern point, on which the depth is about 2 fathoms at low water.

Eastern shore.—Banlin or Banrim river entrance is eastward of Saddle island, and from its northern side, on which is Seaward peak, the east coast, to the entrance to Pakchan river, trends in a north-north-east direction for about 8 miles to the entrance to Renong river, and is bordered by a sandbank which extends for about a mile, but nearly midway a spit, with a depth of 3 fathoms over it, extends for 2 miles westward, and has Round islet on its extremity.

Goh Phi, a small island situated to the northward of the entrance to Renong river, is connected to the mainland at low water, and has a sandbank extending southward of it.

Chart 216b, Mergui archipelago. Var. 0° 40′ E.

Light (*Lat. 9° 58′ N., Long. 98° 35′ E.*).—A *white fixed* light is occasionally exhibited from a stone tower on Goh Phi island, and should be visible, in clear weather, from a distance of 3 miles.

Buoy.—A buoy marks the extreme of the sandbank extending southward of Goh Phi, but no dependence should be placed on it.

Entrances.—Depth.—There are two entrances into Pakchan river, the northern being between the southern edge of the large bank which extends 11½ miles west-south-west from Point Victoria, and has long island on this edge, and the unexamined bank which apparently extends a similar distance from Point Victoria in a south-west direction.

This channel, about two miles wide at the entrance, has depths of from 4 to 5 fathoms, but within its northern part is obstructed by South island and an islet which lies about a mile south-west of it, and the channel is either close southward of South island, where the depth is said to be 2½ fathoms, or over a portion of the northern part of the unexamined bank, where the charted depth is 3 fathoms, and between Boundary island and the islet mentioned as south-west of South island. After the unexamined bank is crossed the depths increase to from 7 to 10 fathoms between Victoria island and Point Victoria.

Bell passage, the southern entrance, is between the south edge of the unexamined bank and the western and northern sides of Saddle island, with Tree islet on that side of the channel; it then passes along the south-east sides of Dyke, Festing, and Victoria islands, and between them and the shoal extending off the mainland.

In this channel the depths are from 6 to 7 fathoms 2 cables westward of Tree islet, from 4 to 6 fathoms to the north-east end of Saddle island, and from 4 to 5 fathoms to Dyke island, decreasing to 3 fathoms when south-east of Victoria island, and increasing within.

Outer anchorages.—Anchorage may be obtained in depths of from 5 to 6 fathoms, inside the entrance to Bell passage, and about 1¼ miles westward of Harry head.

There is good anchorage, sheltered from the south-west monsoon, in a similar depth, off the north-east side of Delisle island.

Inner anchorages.—Anchorages may be obtained off Goh Phi, in a depth of 3¼ fathoms, with that island bearing East, distant about one mile; or eastward of Victoria point, where a vessel will be out of the influence of the tidal streams if anchored well in towards the bay on that side.

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Chart 216b, Mergui archipelago. Var. 0° 40′ E.

Directions.—Northern entrance.—Both the chart and the sailing directions must be used with extreme caution, and a vessel from the northward should not stand into a less depth than 8 fathoms towards the bank extending off the mainland to the northward of the entrance.

When approaching the entrance from the northward, Hastings island should be kept open of both the south entrance point to Hastings harbour and Bengal point, bearing about N. 26° W., with a clear vista through that harbour, and used as a stern mark, steering S. 26° E., until North island is just open northward of Long island, bearing about N. 44° E., which leads in the channel over the flats, in depths of 4 to 6 fathoms at low water.

When the southern point of South island bears East, steer for it, and round it at the distance of about a cable, in order to clear two rocky patches, awash at half tide, lying about 3 to 4 cables southward of the island; when eastward of South island steer to pass between Point Victoria and Victoria island, all rocks being above water.

If Long and North islands are not visible from the entrance of the channel, bring Harry head, the north-west point of Saddle island, to bear East, and the highest peak of St. Matthew's island about N.W. by W. ¼ W., and steer N.E., bringing Long island just open northward of North island as soon as these islands are seen.

Or, bring the sloping southern extreme of Boundary island in line with a small round island eastward of it, bearing about E. by N., and steer on this mark until Victoria point is in line with the north-western point of Victoria island, N. 65° E., when steer for it, and round the north-western point of Victoria island at the distance of a quarter of a mile, the least depth being 3 fathoms.

In all the channels the flood stream sets northward, and the ebb southward, at the rate of 2 to 3 knots an hour.

Bell passage (*Lat. 9° 50′ N., Long. 98° 24′ E.*).—Sailing vessels should not attempt this passage on account of the strong tidal streams, but it is used by the mail steamers.

Approach with the centre of Saddle island bearing between E. by S. ½ S. and N.E. by E. ½ E., until about 2 miles from it, and when Tree islet is made out steer to pass 2 to 3 cables westward of it, and in mid-channel between Spiteful rock and Harry head; thence pass a quarter of mile northward of Stainer rock; on this course the depths are 4 to 6 fathoms, and the banks southward of Mostyn island are avoided. (*See* pecked line on 216b.)

From abreast Stainer rock, steer towards Dyke island, passing eastward of the rock, which is about 8 feet high and has trees on it,

Chart 216b, Mergui archipelago. Var. 0° 40′ E.

at the extremity of a spit extending eastward of Mostyn island; thence pass about 2 cables eastward of Dyke island; on this course the depth is 4 to 5 fathoms; pass about one cable eastward of the islands lying immediately southward of Victoria island, where there is a depth of about 3 fathoms, and 2 cables eastward of Victoria island, to clear the large sandbank which extends from the mainland southward of Renong river.

Caution.—As the channels are not buoyed, and the chart and directions are old, great caution is necessary in navigation.

Steam vessels passing between Saddle island and Spiteful rock should keep a good speed, as the tidal streams here are sometimes strong; both flood and ebb streams set towards Spiteful rock and the sandbank south-westward of it. The tidal stream in this passage runs at rates of from 4 to 5 knots an hour at spring tides. When past Spiteful rock there is smooth water and good shelter from the South-west monsoon.

Tides.—It is high water, full and change, at the anchorage off Goh Phi at 10h. 40m.; springs rise 11½ feet, and neaps 8½ feet.

Tidal streams.—In all the channels the flood stream sets to the northward and the ebb to the southward at rates of from 2 to 3 knots an hour.

The ebb tidal stream from Pakchan river splits at the north-eastern point of Victoria island, one part setting westward and the other southward; both streams are rapid at spring tides. Tidal influence is felt in the dry season for 10 miles above Kra, at which place the spring rise is 8 feet.

Renong river (*Lat. 9° 58′ N., Long. 98° 36′ E.*), flowing into Pakchan river opposite Point Victoria, is small, narrow, and has a depth of 1½ fathoms on its bar, the depths shoaling gradually to it from 5 fathoms westward of the buoy which marks the shoal extending from Goh Phi; nothing larger than a steam launch can cross the bar, and boats can only ascend the river for about one mile.

Town.—At 4 miles up Renong river is a landing place, whence a road leads to the Rajah's residence (about one mile from the river). The town of Renong is steadily increasing in importance, and in its locality are large tin mines, from which a great quantity of tin is exported.

Communication.—There is fortnightly communication between Renong, Rangoon, and Penang.

Supplies.—Fresh water, firewood, and all kinds of provisions may be obtained at reasonable prices.

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Settlement.—The settlement at Point Victoria, Kawsong, is the southernmost in Burma, and is a small frontier station, facing the Siamese state of Renong; it consists of about 80 bamboo huts, built under a clump of cocoanut palms near the point, and inhabited by Malays. On the summit of the hill at the point, are the military police barracks and the houses of the Assistant Commissioner.

Communication.—The British India S.N. Company have a fortnightly service of steamers from Mergui, which proceed to Maliwun, and a small coasting steamer, running between Tavoy and Penang, calls about every six weeks.

River above Point Victoria.—There are apparently depths of from 4½ to 10 fathoms in the river for about 10 miles above Point Victoria, but for this distance the banks are fronted by sand and mud flats, with channels over, or between, them; during the rainy season, or that of the South-west monsoon, small steam vessels reach the Siamese town of Kra, which is 40 miles from the entrance, and where the breadth of the river is about 250 feet; above this it becomes tortuous.

Kikafoi is the northernmost outpost on the river, and between it and Point Victoria the only village of importance is Maliwun, which is situated 9 miles up the river of the same name, a tributary of the Pakchan; it is a small tin-mining settlement and rubber plantation, but, the river being shallow, it is only accessible to light-draught steam vessels

Maliwun river (*Lat. 9° 59′ N., Long. 98° 38′ E.*) flows into the Pakchan river about 12 miles above the entrance of the latter, and is a broad and deep stream, available for vessels of 12 to 13 feet draught as far as the entrance to Lama river. Above that the Maliwun becomes tortuous and narrow, and can be navigated as far as the mail station by steam launches.

Directions.—From abreast Point Victoria keep in mid-channel, and pass eastward of the rocks, which show above water, off Goh Korlek; then close the west bank of the river, keeping westward of all the islands up to the entrance of Maliwun river, and thence proceed in mid-channel to the anchorage below Lama river entrance.

To proceed up Pakchan river above the Maliwun, steer between Goh Mut and Goh Khuang, where there is a depth of about 16½ feet at low water, then close the west bank of the river, keeping about 2 cables from it, and avoiding a rocky patch which dries about 4 feet, and lies about 1½ cables off the northern entrance point of Great Kumaon river. Continue about the same distance from the west bank past the entrance of Little Kumaon river.

A rocky patch, which dries at three-quarters ebb, lies about half a cable from the west bank, three-quarters of a mile northward of Little Kumaon river entrance. Vessels of light draught can proceed as far as Well hill, about 4 miles above Little Kumaon river, keeping the west bank. Above Well hill the river is only navigable for steamers of about 10 feet draught at high water.

COAST.—From Pakchan river entrance, the coast trending south-south-westward for about 44 miles, to the mouth of Taukopah or Kopah inlet, is mostly low, densely wooded, and intersected by numerous rivers and creeks; not having been examined it should not be approached. A range of mountains extends along about 10 miles inland, Kau Da Chung Dung, the highest and most remarkable peak of which, presents an almost perpendicular appearance. A number of islands, mostly surrounded by reefs, and connected with the mainland by sandbanks, lie off the coast.

Sugar Loaves (*Lat. 9° 30′ N., Long. 98° 20′ E.*), a group of high, bold islands, lie about 11 miles southward of Delisle island; the group consists of Goh Jam Jai and Goh Jam Nai, two large islands, and several smaller ones. Goh Jam Jai, 700 feet in height, the largest and highest, is the western island of the group, and there is a depth of 10 fathoms 3 miles westward of it.

About 3 miles north-eastward of the group is Sir Elijah Impey island or Goh Kang Kan, high, wooded, surrounded by rocks, and having White rock off its northern side; about 2 miles southward of the group is Metcalfe island or Goh Lan, also high and wooded; north-westward of it is a small island and a white rock.

Hayes island or Goh Khai Jai, about 6 miles south-southwest of Metcalfe island and about 4 miles northward of Takua Pa, the north point of Goh Rah, is round, high, and wooded; northwestward of it is Umbrella island, small, rocky, and with a single tree on its highest point looking somewhat like an umbrella. Both these islands are surrounded by large sandbanks and rocks, and at low water the sea breaks in several places westward of them.

Pia Sima, the highest mountain in the vicinity of Kopah inlet, and about 9 miles east-north-eastward of Takua Pa, culminates in three peaks, each upwards of 3,500 feet high.

Goh Rah, of which Takua Pa is the northern point, is a high, thickly wooded island, with deep water along its western coast; it lies north of Goh-Pra-Tang, and extends northward for about 4½ miles.

Light, Takua Pa.—*Proposed.*

Shoal.—A shoal, with a depth of about 3 fathoms on it, lies 2½ miles north-westward of Takua Pa.

Chart 216b, Mergui archipelago. Var. 0° 40′ E.

Hayes island and Takua Pa should not be approached within a distance of about 5 miles, except bound for Pak Kura.

TAUKOPAH or KOPAH INLET is a large river, in the province of Muang Taukopah belonging to Siam; it has three entrances, the principal one, Pak Kura, lying between Goh Rah and the mainland. For a distance of 15 miles below the town, the depth is only from 4 to 5 feet at low water springs; between this and the sea there is apparently not less than 2 fathoms.

Pak Kura (*Lat. 9° 16′ N., Long. 98° 19′ E.*).—**Directions.**—The directions for Taukopah inlet must be used with caution, as the survey is very old, and changes may have taken place; it is also stated that it would not be safe for a vessel of moderate size to attempt to enter it, as the soundings alter suddenly from 6 fathoms to about 2 fathoms, if any deviation is made from the channel, which is narrow and difficult to keep.

Approaching Pak Kura, steer East for Takua Pa, to avoid the shoal west-north-westward of it, and round the northern end of Goh Rah at the distance of half a mile, where the depths are from 5 to 6 fathoms. From the north-eastern point of Goh Rah steer S. by W. ½ W., keeping close along the island side, and passing about 2 cables distant from a projecting bluff on the eastern side of Goh Rah, in order to avoid a sand spit which extends from the mainland to within 3 cables of this bluff; on this course the depths are 4 and 5 fathoms.

When past the bluff, steer South for about 1½ miles, and then keep gradually round to the south-eastward to the middle of the river; in this reach depths of 3 fathoms at high water have been reported. Near the end of this reach, there is a large group of fishing stakes on the mainland side and southward of two small islands, which, when sighted, steer for, to clear a sandbank extending from the eastern point of Goh-Pra-Tang, and a smaller bank, with 2¼ fathoms at low water, lying 3 cables north-eastward of it.

When close to the fishing stakes, steer about S.W., keeping in mid-channel, and pass eastward of a black beacon, surmounted by a cone, off Macaulay point, marking a patch of broken ground on which, in some places, is a depth of only 9 feet at low water, spring tides; on this course the depths are 4 to 5 fathoms. In passing the beacon, the mainland side of the channel should not be approached closely, as a sandpit, which dries at low water, extends well into the channel north-eastward of Feather tree. There is anchorage for a vessel of 12 feet draught about half a mile northward of Feather tree.

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Vessels of less than 12 feet draught go up the river towards Taukopah, and about 2½ miles within the entrance anchorage may be obtained in a depth of 2 fathoms at low water, close to a small, shallow creek, at low water, passable only for small boats, through which the distance to Taukopah town is considerably shortened.

From this upper anchorage the main river runs south-eastward for about 5 miles, then south-south-westward for 4 miles, and then southward for 5 or 6 miles, and is shallow; steam cutters being only able to reach a point which is about 4 miles from the town by river, and 1½ miles by road.

Taukopah (Kopah) town (*Lat. 8° 48′ N., Long. 98° 22′ E.*), where the Rajah resides, is situated about 15 miles from the upper anchorage, on the west bank of the river, and is surrounded by tin mines and large plantations, the inhabitants being mostly Chinese. The houses are mostly of bamboo and atap, but there are some brick buildings and a good market, where provisions and vegetables may be procured.

Besides Taukopah, which, next to Tongka, has the largest export of tin on the coast of Siam, there are several mining villages along the banks of the river, and the land about the town and to the northward is undulating and mountainous.

Communication.—There is fortnightly mail communication with Rangoon *viâ* the coast, and Penang *viâ* Tongka.

Tides.—At the anchorage 15 miles below Taukopah it is high water, full and change, at 10h. 40m.; springs rise about 10 feet, neaps 7 to 8 feet, but the tides in the river are, on account of the many outlets to the sea, very irregular.

Tidal streams.—The stream seldom runs at the rate of more than 4 knots an hour in the upper part, and from 2 to 3 knots in the lower part of the river.

Along the coast from Goh Rah to the southern point of Salang island, the flood stream sets northward, the ebb southward, at the rate of from one knot to 2 knots an hour, within 10 or 12 miles of the coast; farther out it is weaker and more dependent on the winds.

Pak Kruen inlet (Bang-yee), the middle entrance to Taukopah inlet, is about 15 miles southward of Pak Kura, and has on each side a large sandbank, partly dry at half tide, and extending from one mile to 1½ miles seaward, on both sides of the entrance. In the approach and distant about 3¼ miles from the entrance, is a large sand flat, on which is a depth of about 1¾ fathoms at low water, spring tides; this bar or flat seems to have the same depths all over, and without any deeper channel across it. In the channel between the entrance points the deepest water, 5 to 7 fathoms, is along the northern bank.

Light.—On the southern shore of Pak Kruen inlet, and about 2 miles southward of Elbow point, a *white fixed* light is occasionally exhibited.

Directions.—Leaving Taukopah inlet in the North-east monsoon, this channel is safe and easy for vessels of light draught, and from between the sandbanks steer W.S.W. to sea.

Entering this channel from seaward is more difficult, as the entrance between the sandbanks off the points cannot then be seen, and it should not be attempted without local knowledge. The sandbanks here do not shift, and the passage remains the same. In the South-west monsoon there is generally a heavy swell on the bar, and Pak Kura is then much to be preferred.

Goh-Pra-Tang.—Northward of the entrance to Pak Kruen is Goh-Pra-Tang, a large, low, thickly-wooded island extending in a north and south direction for about 9 miles; it is separated from Goh Rah further northward by Pak Tjik, a narrow entrance nearly choked by sandbanks and rocks, and only passable for boats. The west coast of Goh-Pra-Tang is low and sandy, with depths of from 8 to 10 fathoms at about 2 miles off it.

Goh Gah (*Lat. 8° 55′ N., Long. 98° 14′ E.*), a small sandy island with a few small trees on it, situated about one mile from the coast about 7 miles southward of Pak Kruen, is surrounded by extensive sandbanks, which are fronted by rocks surrounded by depths of from 2 to 5 fathoms, and partly visible at low water; it should not be approached nearer than 4 miles. Between the island and the mainland are sandbanks with only a few feet of water on them; 4 to 5 miles westward of the island are depths of 10 to 12 fathoms, but casts of 5 and 6 fathoms have been reported.

Pak Goh, about 4 miles south-south-eastward of Goh Gah, and the southern of the three entrances to Taukopah inlet, is a passage between sandbanks, said to be stationary, with depths of 2½ to 3 fathoms at low water for about 2 miles. To enter between the sandbanks, steer in with the low casuarina tree point on the southern shore bearing E.S.E., and inside the bar the water will deepen to 5 and 6 fathoms for a short distance, whence it becomes narrow and shallow.

The land around is low and richly wooded, but there are numerous small creeks, and at high water a large part of the country around is flooded, making it little else than a mangrove swamp. During the fine season Pak Goh may be used with advantage, but in the South-west monsoon the northern entrance is the only safe one.

Tides.—It is high water, full and change, in Pak Goh at 10h. 40m.

Tidal streams.—The flood and ebb streams are regular, and run at a rate of from 2 to 3 knots an hour.

COAST.—Lem Krang Nai is a low point about 2½ miles southward of Pak Goh; reefs and broken ground extend about one mile off it.

Lem Krang Jai, 5 miles southward of Lem Krang Nai, is a low, sandy point, covered with high trees; a rocky reef extends about 2 miles westward of it, some of the rocks of which are visible at low water. This point should not be approached nearer than 4 miles, or to a less depth than 10 fathoms; and the whole coast from Lem Krang Jai to Lem Lajan, 8 miles southward, should not be approached closely, as the ground is rocky and uneven.

The coast from Lem Krang Jai to Klong Kokak, about 4 miles southward, is low and wooded, while thence to Lem Lajan it is high, with hills close to the sea. Southward of Lem Lajan the coast is also low and wooded.

Boundary.—Lem Lajan is the western point of the boundary between the Monthons of Taukopah and Takuatung.

Klong Kokak (*Lat. 8° 42′ N., Long. 98° 16′ E.*) is a river about 4 miles northward of Lem Lajan, some distance up which is the village of the same name with important tin mines in its vicinity. Large sandbanks extend off the mouth of the river. About one mile northward of the Kokak is a smaller river.

LEM THAM TJOB, or CAPE DOLPHIN, the western extreme of a peninsula, is 500 feet high, bold, and steep-to, with a depth of 10 fathoms a short distance off it, and the only high point on the coast between Goh Rah, at the mouth of Taukopah inlet, and Lem Goh Phra Chao, in Salang island. Northward of Lem Tham Tjob, the peninsula ends with a round topped hill, and rocky ground extends northward for about half a mile from the point, most of the rocks being visible at low water. The high land of the peninsula forms the left bank of Klong Bagatae.

KLONG BAGATAE or Tang Pran river is broad and 4 to 6 fathoms deep for about 3 miles within its entrance, where, abreast Klong Gatae, is a rock above water, beyond which vessels of over 8 feet draught cannot ascend.

Ban Tapmo is a small village on the mouth of Klong Lam Rin, the first creek on the eastern bank, but Ban Bagatae, a large village with tin mines, is situated some miles further up this creek.

Numerous creeks and small rivers fall into Klong Bagatae, and several villages are situated on its banks. Important tin mines are situated close to this river, but they are being worked under disadvantages, as, in consequence of no steamers calling here, the tin has to be carried on elephants, over high hills, to the Rajah's residence in Takuatung.

Anchorage.—The anchorage in the river in depths of from 3 to 5 fathoms, over muddy bottom, is off Ban Tampo, and well sheltered from all winds.

Supplies.—Fresh provisions and water may be obtained at Ban Bagatae village.

Directions.—Enter with Lem Lajan bearing East, which leads northward of the rocks extending from Lem Tham Tjob peninsula. When the river is fairly open, steer in, keeping to the peninsula side, where the deepest water is, and inside the northern point of which there is no danger, but on the eastern side, between Lem Lajan and Ban Tapmo, is a sandbank fronted with rocks extending nearly one mile off-shore, mostly visible at low water; anchor as directed.

Chart 842, Sayer islands to Langkawi island.

COAST.—From Lem Tham Tjob, the coast trends in a southerly direction for 16 miles to Bataluk, and consists of sandy beaches, with trees to the water's edge, and backed by high wooded hills; there are a few villages on this stretch of coast. Hin Lompuk, a group of rocks about 6 feet high, with depths of 5 to 7 fathoms close-to, lie about one mile north-westward of Bataluk, and about half a mile off the coast; north-eastward of them are two smaller rocks close in-shore.

Bataluk (*Lat. 8° 18′ N., Long. 98° 16′ E.*) is an inlet fronted by shallows and banks extending off a short distance, and into which three small rivers flow—Klong Tasai from the north, Klong Kli from the east, and Klong Gva from the south; the first is the largest, and runs parallel with the coast (from which it is only separated by a sandbank) for about 4 miles, and then turns eastward; at the point where it alters its direction is Ban Tasai village.

Supplies.—Poultry and fresh water may be procured at Ban Bang Kli, a village at the mouth of Klong Kli, and the water in Klong Tasai is fresh.

Coast.—From Bataluk the coast, which, with the exception of Hin Lompuk, appears to be clear of danger from Lem Tham Tjob, trends southward for 7 miles to Lem Pak Phra, at the entrance to Papra strait or Pak Phra, and consists of sandy beaches with trees down to the water's edge, backed by high wooded hills.

Depths off-shore.—Between Lem Tham Tjob and Lem Pak Phra the depths off the coast gradually decrease from seaward to

6 to 8 fathoms at half a mile off-shore, but it should not be approached within a distance of 3 miles, as it has not been examined.

Lem Pak Phra, the south-western point of the province, is noticeable by a group of high trees and a conical-shaped hill, about 200 feet high, just within it; about 2½ miles northward of it is Koh Pilai, a small hill close to the water's edge, which is the only hill on the coast between Lem Tham Tjob and Lem Goh Phra Chao in Salang island, but it is not easily identified.

SALANG or JUNKSEYLON ISLAND, occupied by the Siamese of Ligor, is separated from the Malay peninsula by Papra strait or Pak Phra, and is about 24 miles in length, 11 miles in greatest breadth, and divided in two Rajah-ships of about equal size; the northern being named Salang, and the southern Puket. The principal towns are Bandon, Tongka, Kathu, and Tharúa, the old capital; the population of the island, consisting of Malays, Chinese, and Siamese, being about 33,000. The north shore of Papra strait is under the Rajah of Takuatung.

Salang island is rich in tin mines, which appear to have been worked by Chinese miners for centuries, and in many places their primitive method is adopted, with the result that during the dry season operations are stopped for want of water.

West coast.—The west coast of Salang island trends in a southerly direction, with some projections for nearly the whole length of the island, and has several large bays with deep water, but none affording any protection during the South-west monsoon; except for a small portion about 8 miles from the north point, the northern part of this coast is low and wooded, with hills of moderate height immediately within it.

The southern part is a range of mountains from 1,000 to 1,750 feet high, thickly wooded, and sloping gradually northward and southward, and the whole of this side of the island is steep-to, with 10 or 12 fathoms close to the shore. Goh Gavai, two small islands, one of which is 50 feet high, the other lower, lie close together one mile south-westward of Lem Son, 8 miles southward of the north-western point of the island, and have deep water around them.

Bandon river (*Lat. 8° 2′ N., Long. 98° 16′ E.*) enters the sea just south of Lem Son; on it is the town of Bandon, which contains about 100 houses.

PAK PHRA or PAPRA STRAIT, about half a mile in width, and separating Salang island from the Malay peninsula, is about 14 miles long, the land on both sides being mostly low and wooded, but the capes or lems are high, with hills of moderate height on the northern side. The natives are very superstitious about this strait (its name signifying Lord's mouth), which is much used by junks. Along both shores of the strait are several villages where provisions and water may be obtained.

The narrowest part of Papra strait is between Lem Hin on the mainland and Lem Khun on Salang island, eastward of which there is a sandbank, dry at low water; southward of this bank the depth is 9 feet at low water, whilst there are 4 and 5 fathoms on the northern, western, and eastern sides of it. Another large sandbank extends from the western side of Lem Asam, the channel lying between it and the bank just described.

Goh Galah, a small white, rocky island, is situated 1½ miles south-eastward of Lem Khun, and Goh Janak is a small island lying a quarter of a mile south-westward of Goh Galah. South-westward of Goh Janak there are extensive sandbanks, dry at low water, and southward is Tamaprau river, with the town of the same name on its banks, at 2 miles from the mouth; Muang Mai, a larger town, is situated 1½ miles further southward, but boats cannot go beyond Tamaprau.

Bar.—Depths.—The depth on the bar at the western entrance, which is subject to great change, varies from one fathom to 3 fathoms at low water, and the channel is tortuous and difficult even for boats, so that the passage of the strait should not be attempted without the assistance of a pilot. Off the northern entrance point a reef of rocks, only visible at low water, extends a short distance; shallow and shifting sandbanks front both points.

In the South-west monsoon the sea breaks entirely across the western entrance, but in the North-east monsoon the bar is generally smooth.

Anchorages (*Lat. 8° 11′ N., Long. 98° 18′ E.*).—Inside the bar there is good anchorage in depths of from 5 or 6 fathoms; and thence to Lem Khun, 4½ miles within the bar, there is a good channel with from 4 to 6 fathoms at low water.

There is also good anchorage, in 4 or 5 fathoms water, eastward of Goh Janak and Goh Galah.

Directions.—Proceeding eastward, pass 2 cables north-eastward of Goh Galah, and then steer to pass 1½ cables off Lem Sai; in this part there are depths of 4 or 5 fathoms. Then steer to pass about 2 cables northward of Goh Rangam Jai, a round island, like all the rest in this locality, covered with trees; between these two places the channel, which is formed between the fringing sandbanks, is little more than a cable wide, and has 12 feet at low water, spring tides, with soft mud bottom.

Chart 842, Sayer islands to Langkawi island. Var. 0° 40′ E.

From Goh Rangam Jai steer to pass about 3 or 4 cables southward of Goh Rangam Noi, the water gradually deepening as the latter is approached; pass Sam lem or Cape Three points, the north-eastern point of Salang island, at from 3 to 4 cables distant, in a depth of 7 fathoms, 5 cables southward of Goh Leng and 3 cables northward of Goh Thanan or Pulo Chupo, a small round island one mile eastward of Sam lem. Leave Goh Thanan about one mile to the westward, and then, if bound to Tharúa harbour, steer between Goh Ret and Goh Naka Joi, in about 6 fathoms water.

Tides.—The tides in Papra strait are very irregular. At the bar the times of high and low water seem to correspond nearly with those at Puket, where it is high water, full and change, at 10h. 10m.; the tides rise from 6 to 8 feet in the middle of the strait.

Tidal streams.—In the strait, the stream of the flood sets in from both sides and meets at the sandbank of Lem Khun, and the ebb stream runs out of both entrances to the strait. In the middle of the strait there is hardly any tidal stream, but at the western entrance the tidal stream sometimes attains a rate of 6 knots, with only half that velocity at the eastern entrance.

For the description of the remaining portion of Salang island and the adjacent coast, *see* China Sea Directory, Vol. I.

PULO RAJA, situated 10 miles southward of Salang island, rises to a height of 1,064 feet in its south-western part, while its north-eastern part is low. (*View B on 842.*)

Gulnare cove, at the north-western point of Pulo Raja, is about half a mile long by a quarter of a mile wide, having a depth of 9 fathoms, over sand, in the centre. There is a small inlet on the northern side of Pulo Raja, into which a stream flows.

Overfalls.—There are heavy overfalls between Pulo Raja and Brothers islands.

BROTHERS ISLANDS (*Lat. 7° 30′ N., Long. 98° 20′ E.*), situated about 15 miles southward of Salang island, are densely wooded, steep-to, and nearly connected by a reef. The northern island, 517 feet high, has a detached rock lying 3½ cables off its northern end. The southern island, 239 feet high, is of nearly uniform height; a reef extends about one mile from its southern point. (*View B on 842.*)

Currents.—Southward of Salang island, during the North-east monsoon the current sets north-westward; during the South-west monsoon it sets south-eastward, but after strong westerly or west-north-westerly winds the current, southward of Brothers islands, sets eastward.

General charts 830, 70.

PARTICULARS OF DRY DOCKS, PATENT SLIPS, &c.

Port.	Name of Dock.	Length.		Breadth of Entrance.	Depth at H.W.O.S.		Lifting Power.	Date Built.	Remarks.
		On Blocks.	Over all.		On Sill.	On Blocks.			
		Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Tons	Year	
Colombo	Harbour Graving Dock	708 0	711 0	83 10	32 0	32 0	—	—	722 and 725 feet in length respectively, with caisson in outer stop.
	Patent Slip	200 0 (cradle)	—	50 0 (cradle)	Forward Aft	10 6 21 6	1,200	1904	
Calcutta	Caledonia Dock......	342 0	367 0	44 6	15 9 (Approx.)	—	—	—	Can be lengthened 150 ft.
	Calcutta (Port Commissioners)	348 0	355 0	50 0	19 11	—	—	1882	Can be lengthened 300 ft., and has a breadth of 63 feet inside at the level of the sill.
	Húgli	305 0	310 0	44 0	22 0 17 6	21 0 16 6	—	—	When two depths are given the greater is the average between June and October, and the lesser the same from November to May. The Commercial dock can be lengthened 40 ft. The Húgli dock has a well for unshipping rudders.
	Commercial	230 0	234 0	41 0	13 4 8 10	—	—	—	
	British India S.N. Co. Howrah, Upper ..	323 6	345 0	52 4	16 10 to 26 0	—	—	—	
	,, Lower ..	190 0	209 0	40 6	19 2 14 9	—	—	—	Not used for docking.
	Union, Upper	337 5	346 5	72 0	14 3 to 23 9	—	—	—	
	,, Lower	354 6	369 6	57 0	15 9 to 25 3	—	—	—	

PARTICULARS OF DRY DOCKS, PATENT SLIPS, &c.—*Continued.*

Port.	Name of Dock.	Length.				Breadth of Entrance.		Depth at H.W.O.S.				Lifting Power.	Date Built.	Remarks.
		On Blocks.		Over all.				On Sill.		On Blocks.				
		Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Tons.	Year.	
Calcutta—*continued* ..	Kidderpur Government New Dock	345	0	352	0	59	0	19	0	19	0	—	1891	Will take a 2nd class cruiser.
	Port Commissioners ..	521	0	531	0	69	6	20	6	—		—	1891	Will take a 1st class cruiser.
	I. G. S. N. Co. Dry Dock.	—		600	0	80	0	4 0	3 3	4 0	3 3	—	—	
	„ „	—		600	0	65	0	4 0	3 3	4 0	3 3	—	—	
	Patent Slip:—													
	I. G. S. N. Co., No. 1	255 (cradle)	0	—		—		Forward Aft		5 12	0 0	600	1887	
	„ „ No. 2	255 (cradle)	0	—		—		Forward Aft		5 13	0 0	800	1895	
	„ „ No. 3	200 (cradle)	0	—		—		Forward Aft		4 8	6 0	450	—	
	Rivers S. N. Co.	250 (cradle)	0	—		25 (cradle)	0	Forward Aft		5 15	0 0	900	—	
Rangoon	Patent Slip..........	180 (cradle)	0	—		45 (cradle)	0	Forward Aft		7 10	0 0	—	1860	
	Gridiron	230	0	—		45	0	—		13	0	—	1860	

PARTICULARS OF WET DOCKS BASINS, LOCKS, &c.

Port.	Name of Dock, Basin, &c.	Area.	Length.	Breadth.	Depth.	Entrance.		Lock.			Quayage.	Date Built.	Remarks.
						Depth H.W.O.S.	Width.	Length	Breadth.	Depth on Sill at L.W.O.S.			
		Acres	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet		
Calcutta	Wet Dock	33	2,600	600	26	26	60 &80	—	—	—	5,400	1892	The Basin is entered by a lock pointing up stream, and single gates pointing down stream, and the Wet dock is entered from the Basin by a double passage. The water level in the docks is maintained at a higher level than that of high water in the river, by pumping.
	Basin	9½	600	680	34 mean	23 mean	60 80	400 —	60 —	23 mean	1,050	1892	

LIST OF PRINCIPAL PORTS, GIVING PARTICULARS OF DEPTHS, &c.

Port.	Depth at L.W.O.S. in channel of approach.	Depth at L.W.S.T. at anchorage.	Rise of Tide.	Draught of water allowed when limited by special regulations.	Remarks.
Colombo—					
West entrance	39 feet	30 feet to be increased to 33 ft.	Sp., 2 ft. Np., A few inches.	—	
North entrance	36 feet				
Galle—					
West entrance	33 to 35 feet	5 fathoms	Sp., 2 feet	—	
Central entrance	7 to 9 fathoms				
East entrance	6¾ to 8 fathoms				
Trincomali	21 to 44 fathoms	11 fathoms	Sp., 2 feet Np., 1½ feet		
Pamban pass	10 feet	19 to 23 feet	Sp., 3 feet Np., 2 feet	—	The greatest draught of vessels using the pass is 11½ feet.
Madras	6 fathoms	—	Sp., 3½ feet Np., 2¼ feet		
Devi river	8 feet	3 fathoms	Sp., 9 feet Np., 6½ feet		
Dhamra river	9 feet	22 to 30 feet	Sp., 9½ feet Np., 6 feet	—	Anchorage at Chandbali.
Calcutta	13 feet	23 to 60 feet	Sp., 15¾ feet Np., 12¼ feet	—	At high water, Springs, vessels of 28 feet, and at high water, Neaps, those of 24 feet can reach Calcutta.
Sagar roads	14 feet	5 to 8 fathoms	Sp., 17 feet Np., 12 feet		
Matla river—					
West Channel	4 fathoms	4 to 8 fathoms at Canning Town	Sp., 10 feet		
East Channel	5 fathoms				
Meghna river	—	—	—	—	Steamers drawing 10 feet reach Narayanganj at high water.

Chittagong	9 feet	18 to 42 feet	Sp., 14 to 16 feet		Vessels of from 25 to 26 feet enter at high water.
Naaf river	13 feet	About 4½ fathoms off Maungdaw.	Sp., 8 to 10 feet Np., 6 to 8 feet		
Mayu river	19 feet	6 to 9 fathoms	Sp., 8 to 9 feet Np., 6 feet		
Arakan river	21 feet	6½ fathoms at Outer and 4 fathoms at Inner anchorage.	—	—	
Ramree harbour	—	3½ to 4 fathoms	Sp., 11 feet Np., 8 feet	—	
Nicobar islands: Nankowry harbour—					
East entrance	19 to 22 fathoms	11 to 21 fathoms	Sp., 8 to 8½ feet	—	
West entrance	27 to 30 fathoms	—	—	—	
Expedition harbour	9 to 13 fathoms	12 fathoms	Sp., 8 feet	—	
Andaman islands: Port Blair—					
South Channel	31 feet	7 to 8 fathoms	Sp., 6 feet	—	
North Channel	21 fathoms	—	Np., 5 feet		
Andaman Strait—					
East Entrance	1¾ fathoms	—	Sp., 7 to 8 feet Np., 4 to 6 feet	—	There is a depth of about 3 fathoms in the strait.
Port Anson	11 fathoms	9 to 11 fathoms	Sp., 7 feet Np., 5 feet	—	
Homfray Strait	1½ fathoms	—	—	—	There is a depth of about 2¾ fathoms in the strait.
Port Mouat	7 to 10 fathoms	4½ to 5 fathoms in Inner harbour.	Sp., 5 feet	—	
Bassein river	3½ fathoms (less reported).	7 fathoms	Sp., 7½ feet Np., 5¾ feet	—	A vessel of 26 feet draught has reached Bassein town.
Rangoon river: West entrance	19 feet (shoaling reported).	—	Sp., 19 feet Np., 13 feet	— —	H.M.S. Terrible, drawing 30ft. 1in., entered the port of Rangoon in 1906.
Monkey point channel	14 feet	26 to 30 feet	—	—	

LIST OF PRINCIPAL PORTS, GIVING PARTICULARS OF DEPTHS, &c.—*Continued.*

Port.	Depth at L.W.O.S. in channel of approach.	Depth at L.W.S.T. at anchorage.	Rise of Tide.	Draught of water allowed when limited by special regulations.	Remarks.
Irrawaddy river	—	—	—	—	Navigable to Bhamo, 800 miles from sea, by steamers of 4 feet draught during the whole season, and to Thayetmyo, 364 miles from sea, by those of 6 feet draught, during the dry season.
Bassein Creek	—	—	—	—	Vessels drawing 8 feet water can pass through.
China Bakir river	—	—	—	—	Vessels of 15 feet draught can enter.
Moulmein river	8 feet	30 to 40 feet	Sp., 14 feet Np., 7 feet	—	Navigable to Moulmein for draughts of 25 and 18 feet, at springs and neaps, respectively.
Yé river	Bar dries	—	Sp., 15 feet Np., 9 feet	—	Vessels of 13 feet draught can reach Yé town at springs.
Heanzay Basin	14 feet	7 fathoms	Sp., 15 to 16 feet Np., 8 to 11 feet.	—	Vessels of 25 feet draught can enter at springs, and of 19 feet at neaps.
Tavoy river, Grindstone island	28 feet	30 feet	—		
Tsinbyubyin and Tavoy	12 feet	13 feet	—		
Mergui	1¼ fathoms	3¼ to 5¼ fathoms	Sp., 18 feet Np., 11 feet		
Pakchan river—					
North Channel	2½ to 3 fathoms	3¼ fathoms at Victoria Point.	Sp., 11½ feet		
South Channel	3 fathoms		Np., 8½ feet		

PLACE—COLOMBO. OBS. △ LAT. 6° 56′ N., LONG. 79° 50′ E.

METEOROLOGICAL TABLE COMPILED AT THE METEOROLOGICAL OFFICE IN DECEMBER, 1907.

MONTH.	BAROMETER, reduced to 32° and Sea Level.		THERMOMETER.				Relative Humidity.	Clouds, 0 to 10, Mean Amount.	RAIN.		WIND.										Gales, No. of Days.	Fogs, No. of Days.	BAROMETER, reduced to 32° and Sea Level.		THERMOMETER.			RAIN.
				Mean.								Number of Days from											Absolute.					
	Mean Height.	Extreme Range.	Mean.	Daily Range	Max.	Min.			Total Fall.	No. of days.	Force, Beaufort Scale.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm			Max.	Min.	Max.	Min.	Range.	Max. Fall in 24 Hours
	50 yrs.	30 yrs.	45 years' Observations.				26 yrs.	31 years' Obs.			From 8 years' Observations.										—	—	30 years.		28 years.			16 yrs.
	Ins.	Ins.	°	°	°	°	%		Ins.														Ins.	Ins.	°	°	°	Ins.
January	29·92	0·36	80	14	87	73	80	4	3·24	7	—	6	14	3	1	0	1	2	4	0	—	—	30·09	29·73	93	65	28	5·10
February	29·91	0·43	81	15	88	73	79	2	1·89	6	—	4	9	3	1	2	2	2	4	1	—	—	30·12	29·69	96	66	30	2·80
March	29·89	0·40	82	14	89	75	80	4	4·75	11	—	1	6	3	2	4	7	3	3	2	—	—	30·09	29·69	96	69	27	6·25
April	29·87	0·35	83	14	90	76	79	5	11·43	18	—	0	2	2	2	4	15	2	0	3	—	—	30·02	29·67	94	69	25	9·15
May	29·84	0·36	83	11	88	77	83	6	12·10	21	—	0	1	1	3	2	22	1	1	0	—	—	30·03	29·67	100	70	30	7·00
June	29·85	0·36	82	10	87	77	84	7	8·35	20	—	0	0	0	0	1	27	1	1	0	—	—	30·01	29·65	92	72	20	7·20
July	29·84	0·39	81	8	85	77	83	6	4·46	13	—	0	0	0	2	4	24	1	0	0	—	—	30·06	29·67	89	71	18	6·52
August	29·87	0·32	82	9	86	77	85	6	3·81	14	—	0	0	0	1	7	17	5	1	0	—	—	30·03	29·71	91	70	21	3·51
September	29·89	0·37	82	11	87	76	84	6	4·98	16	—	0	0	0	1	3	22	3	1	0	—	—	30·07	29·70	91	70	21	3·08
October	29·89	0·47	81	12	87	75	86	6	14·36	22	—	0	0	0	1	1	21	7	1	0	—	—	30·14	29·67	93	68	25	5·73
November	29·90	0·40	81	13	87	74	86	5	12·55	19	—	2	11	2	1	1	7	1	4	1	—	—	30·10	29·70	92	64	28	8·40
December	29·88	0·41	80	14	87	73	85	4	6·35	14	—	4	15	4	1	0	3	0	3	1	—	—	30·11	29·70	94	67	27	3·20
Mean	29·88	0·49	81	12	87	75	83	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	88·27	178	—	17	58	18	16	29	168	28	23	8	—	—	—	—	—	—	—	—
Range	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0·49		—	—	—	—

PLACE—TRINCOMALI. OBS. △ LAT. 8° 33′ N., LONG. 81° 15′ E.

METEOROLOGICAL TABLE COMPILED AT THE METEOROLOGICAL OFFICE.

MONTH.	BAROMETER. reduced to 31° and Sea Level.		TEMPERATURE.				Relative Humidity.	Clouds, 0 to 10. Mean Amount.	RAIN.		WIND.											No. of Days Gales.	No. of Days Fogs.	REMARK.
	Mean Height.	Extreme Range.	Mean.	Mean Daily Range	Max.	Min.			Total Fall.	No. of Days.	Average Hourly Velocity.	Number of Days from N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm			
	19 Yrs.		17 Yrs.	14 years.			17 Yrs.	19 Yrs.	26 Yrs.	15 Yrs.	17 Yrs.	9 years.											
	Ins.	Ins.	°	°	°	°			Ins.		Miles.												
January	29·96	Not obtainable.	77·6	9	90·4	65·3	82	6	5·24	10	11	3	19	3	1	0	1	0	2	2	Not obtainable.	Not obtainable.	
February	29·95		79·3	11	94·7	66·5	80	5	2·22	3	9	1	13	4	1	1	3	0	2	3			
March	29·91		81·4	14	98·8	67·1	80	5	1·51	4	8	1	7	8	4	0	6	0	0	5			
April	29·84		83·5	16	102·1	71·2	79	4	1·83	5	9	0	2	8	4	1	12	0	0	3			
May	29·79		84·2	18	101·8	66·4	76	4	2·57	6	13	0	0	4	1	0	20	5	1	0			
June	29·77		84·3	17	101·4	70·1	75	5	1·60	4	18	0	1	1	0	0	25	3	0	0			
July	29·80		84·4	18	100·8	70·4	74	6	2·16	4	18	0	0	1	0	2	26	2	0	0			
August	29·80		83·1	18	101·6	69·7	76	6	4·48	9	15	0	1	2	0	0	26	1	1	0			
September	29·83		82·9	18	101·0	65·7	74	6	4·37	7	15	0	1	2	0	0	24	2	1	0			
October	29·86		80·9	15	101·4	68·9	80	6	8·35	16	14	0	3	2	0	0	18	2	2	4			
November	29·90		78·7	12	95·0	70·1	86	6	13·22	19	7	2	7	2	1	1	8	2	1	6			
December	29·93		77·3	10	90·8	65·6	87	6	13·93	20	9	4	13	1	1	1	2	1	4	4			
Means and Totals	29·86	—	81·5	15	102·1	65·3	79	5	61·48	107	12	11	67	38	13	6	171	18	14	27	—	—	

Place—Pamban, Obs. △ Lat. 9° 14′ N., Long. 79° 10′ E.

Meteorological Table Compiled at the Meteorological Office in December, 1907.

From 13 Years' Observations.

MONTH.	BAROMETER, Reduced to 32° and Sea Level.		THERMOMETER.				Relative Humidity.	Clouds, 0 to 10. Mean Amount.	RAIN.		WIND.										Gales, No. of Days.	Fogs, No. of Days.	BAROMETER, reduced to 32° and Sea Level.		THERMO-METER.			RAIN.
				Mean.							Force, Beaufort Scale.	Number of Days from											Absolute.					
	Mean Height.	Extreme Range.	Mean.	Daily Range	Max.	Min.			Total Fall.	No. of Days.		N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm			Max.	Min.	Max.	Min.	Range.	Max. Fall in 24 Hours
	Ins.	Ins.	°	°	°	°	%		Ins.														Ins.	Ins.	°	°	°	Ins.
January	30·03	0·22	78	8	83	75	85	4	1·33	2·2	3	7	18	4	0	0	0	0	2	0	—	—	30·14	29·92	92	71	21	5·02
February	30·02	0·35	79	10	85	75	80	3	0·73	0·5	3	2	14	8	1	1	0	0	0	2	—	—	30·15	29·80	91	68	23	3·50
March	29·96	0·24	81	13	89	76	77	3	0·72	0·9	2	0	7	12	6	2	1	1	0	2	—	—	30·07	29·83	94	69	25	1·15
April	29·90	0·26	84	12	91	79	77	3	2·40	3·3	3	0	3	6	10	4	4	1	1	1	—	—	30·01	29·75	95	69	26	4·55
May	29·85	0·26	85	10	91	81	79	3	0·55	1·2	3	0	0	1	4	9	12	3	1	1	—	—	29·99	29·73	95	70	25	1·25
June	29·83	0·23	84	10	90	80	79	3	0·12	0·5	4	0	0	0	2	4	19	4	1	0	—	—	29·93	29·70	96	69	27	0·61
July	29·84	0·30	83	10	89	79	77	3	0·17	0·6	3	0	0	0	1	3	17	7	1	2	—	—	30·00	29·70	94	73	21	2·01
August	29·85	0·27	83	11	89	78	76	3	0·81	0·6	3	1	0	1	3	4	14	5	1	2	—	—	29·97	29·70	93	74	19	2·65
September	29·89	0·24	83	11	89	78	76	3	1·31	2·2	3	1	1	1	3	4	12	4	2	2	—	—	30·03	29·79	93	72	21	4·27
October	29·93	0·28	81	11	88	77	80	4	8·63	9·5	3	3	3	2	3	3	7	4	4	2	—	—	30·08	29·80	92	70	22	4·75
November	29·97	0·34	79	9	85	76	84	4	11·89	12·0	3	8	10	2	1	1	2	1	4	1	—	—	30·11	29·77	89	71	18	5·42
December	30·01	0·35	77	7	82	75	89	4	10·31	9·2	4	12	12	2	0	0	0	0	5	0	—	—	30·18	29·83	89	70	19	3·83
Mean	29·92	—	81	10	88	78	80	3	—	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	38·97	42·7	—	34	68	39	34	35	88	30	22	15	—	—	—	—	—	—	—	—
Range	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0·48		—	—	—	—

PLACE—MADRAS. OBS. △ LAT. 13° 4′ N., LONG. 80° 14′ E.

METEOROLOGICAL TABLE COMPILED AT THE METEOROLOGICAL OFFICE.

MONTH.	BAROMETER, reduced to 32° and Sea Level.		TEMPERATURE.				Relative Humidity.	Clouds, 0 to 10, Mean Amount.	RAIN.		WIND.										No. of Days Gales.	No. of Days Fogs.	REMARKS.
	Mean Height.	Extreme Range.	Mean.	Mean Daily Range	Max.	Min.			Total Fall.	No. of Days.	Average Hourly Velocity.	Number of Days from											
												N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm			
	37 Yrs.		37 Yrs.	15 years.			22 Yrs.	27 Yrs.	94 Yrs.	15 Yrs.	18 Yrs.	15 Years.											
	Ins.	Ins.	°	°	°	°			Ins.		Miles.												
January	30·01	Not obtainable.	75·5	17	92·9	57·6	75	4	0·86	2	6	5	17	6	2	1	0	0	0	0	Not obtainable.	Not obtainable.	
February	29·99		77·1	19	92·8	58·5	74	3	0·28	1	5	1	7	10	8	2	0	0	0	0			
March	29·92		80·8	17	99·9	63·4	74	2	0·39	1	6	0	1	6	18	6	0	0	0	0			
April	29·84		84·7	16	108·9	69·9	74	3	0·61	1	8	0	0	3	18	8	1	0	0	0			
May	29·76		87·4	17	112·9	69·7	68	4	2·03	3	9	0	0	1	13	11	5	1	0	0			
June	29·72		87·3	18	109·5	70·3	65	6	2·07	10	9	0	0	0	3	8	12	6	1	0			
July	29·74		85·2	17	105·7	71·8	67	7	3·84	14	8	0	0	1	2	7	13	7	1	0			
August	29·77		84·0	17	103·8	70·7	72	7	4·65	15	7	0	0	1	3	7	14	5	1	0			
September	29·79		83·8	16	102·3	69·3	73	6	4·70	12	7	0	1	1	4	7	11	5	1	0			
October	29·86		81·1	14	99·1	62·1	80	6	10·84	14	5	5	6	4	4	4	3	2	3	0			
November	29·94		78·1	13	94·8	61·1	81	6	13·55	15	7	11	10	3	2	1	1	0	2	0			
December	30·00		76·0	13	94·7	61·1	79	5	5·32	9	8	13	14	2	1	0	0	0	1	0			
Means and Totals	29·86	—	81·8	16	112·9	57·6	74	5	49·14	97	7	35	56	38	78	62	60	26	10	0	—	—	

PLACE—MASULIPATAM. OBS. △ LAT. 16° 9′ N., LONG. 81° 12′ E.

METEOROLOGICAL TABLE COMPILED AT THE METEOROLOGICAL OFFICE.

MONTH.	BAROMETER. reduced to 32° and Sea Level.		TEMPERATURE.				Relative Humidity.	Clouds. 0 to 10. Mean Amount.	RAIN.		WIND.										No. of Days Gales.	No. of Days Fogs.	REMARKS.
	Mean Height.	Extreme Range.	Mean.	Mean Daily Range	Max.	Min.			Total Fall.	No. of Days.	Average Hourly Velocity.	Number of Days from											
												N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm			
	18 Yrs.		18 Yrs.	12 Years.			13 Yrs.	18 Yrs.	34 Yrs.	15 Yrs.	6 Yrs.	13 Years.											
	Ins.	Ins.	°	°	°	°			Ins.		Miles.												
January	30·03	Not obtainable.	74·4	17	94·0	58·5	73	3	0·20	1	5	2	10	10	8	1	0	0	0	0	Not obtainable.	Not obtainable.	
February	30·02		76·7	19	97·4	60·8	72	3	0·13	1	5	1	3	9	8	6	1	0	0	0			
March	29·92		80·7	19	101·5	63·8	73	3	0·27	1	7	0	1	1	13	13	2	0	0	1			
April	29·83		84·6	18	105·2	62·1	74	4	0·20	1	9	0	0	1	6	16	6	1	0	0			
May	29·72		88·0	18	114·4	68·8	71	5	1·45	4	9	1	1	1	4	12	6	3	3	0			
June	29·67		86·8	17	115·9	71·0	68	7	4·52	11	9	1	0	0	2	3	5	12	7	0			
July	29·69		83·8	15	109·4	71·6	73	7	5·63	15	10	1	0	0	1	1	7	13	8	0			
August	29·72		83·5	14	102·2	71·9	75	7	6·19	15	8	2	0	0	1	1	6	13	8	0			
September	29·76		82·7	14	100·0	72·0	76	6	6·48	15	6	3	0	1	1	2	3	9	10	1			
October	29·86		81·0	13	98·7	68·5	79	6	8·92	12	4	5	7	4	5	2	1	2	4	1			
November	29·96		77·5	14	93·9	60·0	78	5	4·57	6	6	5	12	7	4	0	0	0	1	1			
December	30·02		74·3	16	89·6	57·7	75	4	0·59	2	6	4	14	8	5	0	0	0	0	0			
Means and Totals	29·85	—	81·2	16	115·9	57·7	74	5	39·15	84	7	25	48	42	58	57	37	53	41	4	—	—	

PLACE—CUTTACK. OBS. △ LAT. 20° 29′ N., LONG. 85° 54′ E.

METEOROLOGICAL TABLE COMPILED AT THE METEOROLOGICAL OFFICE.

MONTH.	BAROMETER, reduced to 32° and Sea Level.		TEMPERATURE.				Relative Humidity.	Clouds, 0 to 10, Mean Amount.	RAIN.		WIND.										No. of Days Gales.	No. of Days Fogs.	REMARKS.
	Mean Height.	Extreme Range.	Mean.	Mean Daily Range	Max.	Min.			Total Fall.	No. of Days.	Average Hourly Velocity.	Number of Days from											
												N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm			
	29 Yrs.		29 Yrs.	15 Years.			29 Yrs.	28 Yrs.	38 Yrs.	15 Yrs.	15 Years.												
	Ins.	Ins.	°	°	°	°			Ins.		Miles.												
January	30·03	Not obtainable.	70·8	25	95·6	49·4	64	2	0·36	1	2	3	6	2	1	2	2	2	3	10	Not obtainable.	Not obtainable.	
February	29·98		75·7	25	101·3	50·9	61	2	0·52	2	2	2	4	2	2	3	4	2	3	6			
March	29·88		82·0	25	107·9	60·9	61	2	1·27	3	4	1	2	2	2	8	7	2	2	5			
April	29·77		86·6	24	117·7	66·8	61	3	1·22	3	5	1	2	1	2	10	8	2	2	2			
May	29·68		87·9	22	114·4	68·7	64	4	3·63	9	5	0	2	2	3	9	7	2	3	3			
June	29·58		85·7	16	112·4	73·9	73	7	11·25	16	4	1	2	1	2	6	7	4	3	4			
July	29·58		82·5	11	102·2	73·4	80	8	12·39	23	3	1	2	1	1	4	8	5	2	7			
August	29·63		82·5	11	99·4	73·8	81	7	12·16	24	3	1	3	2	2	5	8	4	1	5			
September	29·71		82·6	12	96·9	70·0	80	7	10·47	18	2	1	2	2	2	4	5	4	2	8			
October	29·86		80·8	15	103·4	64·2	74	4	5·46	10	2	3	7	2	2	2	2	2	2	9			
November	29·99		74·7	20	96·8	49·6	67	3	1·44	3	2	3	9	2	1	0	1	2	2	10			
December	30·05		69·4	24	90·9	49·1	64	2	0·38	1	2	4	7	2	1	1	1	3	2	11			
Means and Totals	29·81	—	80·1	19	117·7	49·1	69	4	60·55	118	3	21	48	21	21	54	60	33	27	80	—	—	

PLACE.—CALCUTTA. OBS. △ LAT. 22° 32′ N., LONG. 88° 20′ E.

METEOROLOGICAL TABLE COMPILED AT THE METEOROLOGICAL OFFICE.

MONTH.	BAROMETER. reduced to 32° and Sea Level.		TEMPERATURE.				Relative Humidity.	Clouds, 0 to 10, Mean Amount.	RAIN.		WIND.										No. of Days Gales.	No. of Days Fogs.	REMARKS.
	Mean Height.	Extreme Range.	Mean.	Mean Daily Range	Max.	Min.			Total Fall.	No. of Days.	Average Hourly Velocity.	Number of Days from											
												N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm			
	44 Yrs.		20 Yrs.	13 Years.			20 Years.		20 Yrs.	15 Yrs.	13 Years.												
	Ins.	Ins.	°	°	°	°			Ins.		Miles.												
January	30·03	Not obtainable.	65·2	21	85·6	45·5	69	1	0·32	2	3	9	4	1	1	1	4	4	6	1	Not obtainable.	Not obtainable.	
February	29·97		70·0	22	91·7	46·2	65	2	1·11	3	4	4	3	1	1	2	5	6	5	1			
March	29·87		79·2	21	100·2	52·3	66	3	1·30	4	6	2	1	1	1	8	10	5	3	0			
April	29·77		85·0	20	105·3	64·1	68	3	1·48	4	8	1	1	1	2	11	11	2	1	0			
May	29·68		85·4	17	105·3	65·0	74	4	5·63	11	7	1	1	2	4	12	9	1	1	0			
June	29·57		84·5	13	106·6	70·2	83	7	10·89	17	6	1	1	2	6	11	7	1	1	0			
July	29·56		83·1	10	94·2	73·6	87	8	11·95	25	5	0	1	3	7	9	8	2	1	0			
August	29·62		82·5	9	92·5	73·0	88	8	12·50	25	5	1	1	3	6	9	7	2	2	0			
September	29·71		82·5	10	93·3	73·2	86	7	9·06	19	5	1	1	4	6	7	7	2	1	1			
October	29·86		80·0	12	92·4	63·2	81	4	3·70	8	3	6	3	4	3	3	3	3	4	2			
November	29·98		72·4	17	87·1	51·1	73	3	0·74	2	3	13	4	2	1	1	1	1	6	1			
December	30·04		65·3	10	84·8	45·0	70	2	0·37	1	3	14	3	1	1	0	1	2	8	1			
Means and Totals	29·81	—	77·9	15	106·6	45·0	76	4	59·05	121	5	53	24	25	39	74	73	31	39	7	—	—	

PLACE—CHITTAGONG. OBS. △ LAT. 22° 21′ N., LONG. 91° 50′ E.

METEOROLOGICAL TABLE COMPILED AT THE METEOROLOGICAL OFFICE.

MONTH.	BAROMETER, reduced to 32° and Sea Level.		TEMPERATURE.				Relative Humidity.	Clouds, 0 to 10. Mean Amount.	RAIN.		WIND.										No. of Days Gales.	No. of Days Fogs.	REMARKS.
	Mean Height.	Extreme Range.	Mean.	Mean Daily Range	Max.	Min.			Total Fall.	No. of Days.	Average Hourly Velocity.	Number of Days from											
												N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm			
	26 Yrs.		29 Yrs.	15 Years.			28 Years.		40 Yrs.	15 Yrs.	19 Yrs.	15 Years.											
	Ins.	Ins.	°	°	°	°			Ins.		Miles.												
January	30·04	Not obtainable.	66·1	22	86·9	45·4	73	1	0·44	1	4	7	5	1	1	1	2	6	5	3	Not obtainable.	Not obtainable.	
February	30·00		70·1	23	91·8	46·4	73	2	1·23	2	4	5	4	1	1	2	3	7	4	1			
March	29·92		76·8	19	98·0	54·6	74	3	2·19	4	6	2	2	3	5	5	6	4	2	2			
April	29·85		80·5	15	95·5	63·2	74	4	4·67	6	7	1	2	2	5	8	7	3	1	1			
May	29·77		81·0	14	98·4	64·5	80	5	9·88	13	6	1	2	3	7	7	6	3	1	1			
June	29·67		80·5	10	98·7	68·0	86	8	22·29	21	7	1	1	3	10	8	4	2	0	1			
July	29·66		80·0	9	96·7	61·3	87	8	22·90	25	7	0	1	4	12	9	3	1	0	1			
August	29·70		79·7	10	97·0	69·8	87	8	19·88	24	6	1	1	3	11	9	4	1	0	1			
September	29·78		80·6	11	99·0	67·8	86	7	13·34	18	5	1	2	4	7	6	4	3	1	2			
October	29·89		79·0	14	93·0	64·2	83	4	5·98	9	3	4	4	3	3	2	2	5	4	4			
November	29·98		74·0	16	93·9	52·2	79	3	1·57	3	3	7	5	1	1	1	1	5	6	3			
December	30·04		67·4	20	87·4	49·1	76	2	0·62	1	3	7	5	1	0	1	2	6	6	3			
Means and Totals	29·86	—	76·3	15	99·0	45·4	80	5	104·99	127	5	37	34	29	63	59	44	46	30	23	—	—	

PLACE—AKYAB. OBS. △ LAT. 28° 20′ N., LONG. 92° 57′ E.

METEOROLOGICAL TABLE COMPILED AT THE METEOROLOGICAL OFFICE.

MONTH.	BAROMETER, reduced to 32° and Sea Level.		TEMPERATURE.				Relative Humidity.	Clouds, 0 to 10. Mean Amount.	RAIN.		WIND.										No. of Days Gales.	No. of Days Fogs.	REMARKS.
	Mean Height.	Ex-treme Range.	Mean.	Mean Daily Range	Max.	Min.			Total Fall.	No. of Days.	Average Hourly Velocity.	Number of Days from											
												N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm			
	30 Yrs.		28 Yrs.	15 Years.			27 Years.		40 Yrs.	14 Yrs.	15 Years.												
	Ins.	Ins.	°	°	°	°			Ins.		Miles.												
January -	30·01	Not obtainable.	70·0	22	90·6	47·3	70	1	0·14	1	3	5	8	3	1	1	2	6	5	0	Not obtainable.	Not obtainable.	
February -	29·97		72·3	24	94·8	48·3	68	1	0·19	1	3	4	5	3	1	0	2	7	6	0			
March - -	29·92		78·0	20	97·5	55·5	71	2	0·46	1	4	2	4	5	2	3	4	8	3	0			
April - -	29·85		82·8	17	99·1	64·3	73	3	1·60	2	4	1	2	3	1	5	7	9	2	0			
May - -	29·78		83·2	13	97·6	68·1	78	6	12·66	13	4	1	2	4	4	7	6	5	2	0			
June - -	29·70		81·2	8	97·3	67·6	87	8	49·43	28	4	1	1	2	6	11	6	2	1	0			
July - -	29·69		80·0	8	91·6	70·1	89	9	51·40	30	4	1	1	1	5	13	7	2	1	0			
August -	29·73		80·2	8	90·6	72·3	88	8	39·25	29	3	0	1	2	6	12	7	2	1	0			
September -	29·78		81·4	9	93·6	72·3	86	7	22·94	22	3	1	2	3	6	9	5	3	1	0			
October -	29·87		81·3	12	92·2	69·0	83	5	11·39	11	2	2	6	5	3	5	3	5	2	0			
November -	29·96		77·9	14	91·6	60·7	80	3	3·38	4	2	3	9	5	2	1	2	5	3	0			
December -	30·01		72·2	18	90·1	51·8	75	2	0·48	2	2	5	9	3	1	1	2	5	5	0			
Means and Totals	29·86	—	78·4	14	99·1	47·3	79	5	193·32	144	3	26	50	39	38	68	53	59	32	0	—	—	

PLACE—NANKOWRY, NICOBAR ISLANDS. OBS. △ LAT. 8° 0′ N., LONG. 93° 46′ E.

METEOROLOGICAL TABLE COMPILED AT THE METEOROLOGICAL OFFICE.

MONTH.	BAROMETER. reduced to 32° and Sea Level.		TEMPERATURE.				Relative Humidity.	Clouds, 0 to 10, Mean Amount.	RAIN.		WIND.										No. of Days Gales.	No: of Days Fogs:	REMARKS.
	Mean Height.	Ex-treme Range.	Mean.	Mean Daily Range	Max.	Min.			Total Fall.	No. of Days.	Average Hourly Velocity.	Number of Days from N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm			
	14 Yrs.		14 Yrs.	13 Years.			13 Yrs.	15 Yrs.	16 Yrs.	14 Yrs.	14 Years.												
	Ins.	Ins.	°	°	°	°			Ins.		Miles.												
January	29·93	Not obtainable.	79·5	9	90·8	71·2	75	5	2·77	8	9	0	9	15	6	0	1	0	0	0	Not obtainable.	Not obtainable.	
February	29·94		80·5	10	92·6	70·2	74	5	1·87	4	8	1	10	13	4	0	0	0	0	0			
March	29·92		81·6	10	92·7	70·2	74	5	2·30	5	6	1	9	13	6	0	1	0	1	0			
April	29·88		82·4	11	94·9	73·2	77	5	4·85	10	5	1	5	7	6	2	6	2	1	0			
May	29·85		81·2	11	96·7	71·0	80	7	13·53	20	6	1	1	2	3	3	17	3	1	0			
June	29·84		80·3	10	92·7	70·2	82	7	13·56	22	10	0	0	0	1	4	23	2	0	0			
July	29·85		79·8	10	92·6	70·3	82	7	12·66	20	10	0	0	0	0	4	25	2	0	0			
August	29·86		79·5	10	93·6	71·0	82	7	11·71	20	9	0	0	0	0	4	24	3	0	0			
September	29·88		79·4	10	92·2	71·5	81	7	11·54	20	9	0	0	0	0	3	21	4	1	1			
October	29·89		78·8	10	99·5	71·0	83	7	14·23	20	5	0	2	3	4	3	13	4	1	1			
November	29·90		78·9	9	95·5	72·0	82	7	13·45	19	5	1	4	8	7	2	7	1	0	0			
December	29·92		78·6	9	91·8	71·0	79	6	11·89	15	7	0	5	15	9	1	1	0	0	0			
Means and Totals	29·89	—	80·0	10	99·5	70·2	79	6	114·36	183	7	5	45	76	46	26	139	21	5	2	—	—	

PLACE—PORT BLAIR, ANDAMAN ISLANDS. OBS. △ LAT. 11° 41′ N., LONG. 92° 42′ E.

METEOROLOGICAL TABLE COMPILED AT THE METEOROLOGICAL OFFICE.

MONTH.	BAROMETER, reduced to 32° and Sea Level.		TEMPERATURE.				Relative Humidity.	Clouds, 0 to 10, Mean Amount.	RAIN.		WIND.										No. of Days Gales.	No. of Days Fogs.	REMARKS.
	Mean Height.	Extreme Range.	Mean.	Mean Daily Range	Max.	Min.			Total Fall.	No. of Days.	Average Hourly Velocity.	Number of Days from											
												N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm			
	28 Yrs.		29 Yrs.	15 Years.			20 Yrs.	28 Yrs.	29 Yrs.	15 Yrs.	13 Yrs.	15 Years.											
	Ins.	Ins.	°	°	°	°			Ins.		Miles.												
January	29·95	Not obtainable.	79·5	11	91·0	67·8	76	3	0·83	2	7	6	17	3	3	0	0	0	2	0	Not obtainable.	Not obtainable.	
February	29·95		79·9	14	92·1	68·5	76	3	1·08	1	5	5	16	3	2	0	0	0	2	0			
March	29·91		81·5	15	95·9	69·9	76	3	0·37	1	4	3	15	6	5	0	1	0	1	0			
April	29·86		83·8	14	98·6	73·3	77	4	2·86	5	5	1	10	6	8	1	2	1	1	0			
May	29·81		82·2	11	99·1	71·4	83	7	16·24	20	7	0	6	2	5	2	10	4	2	0			
June	29·78		80·8	9	94·9	72·7	86	8	18·57	25	10	0	1	0	2	2	20	4	1	0			
July	29·80		80·3	8	90·0	71·9	85	8	15·16	25	11	0	0	0	1	2	23	5	0	0			
August	29·81		79·9	9	89·5	72·9	86	8	15·10	25	10	0	0	0	2	1	21	6	1	0			
September	29·84		79·5	9	91·5	71·9	87	7	19·12	25	9	0	1	0	2	2	17	7	1	0			
October	29·87		80·2	10	92·1	72·4	86	6	11·95	21	6	1	3	3	7	2	8	5	2	0			
November	29·90		80·6	10	91·0	71·4	82	5	8·65	15	7	2	10	4	7	2	2	2	1	0			
December	29·93		79·8	10	90·0	66·0	79	5	5·56	10	7	3	14	6	7	0	0	0	1	0			
Means and Totals	29·87	—	80·7	11	99·1	66·0	82	6	115·49	175	7	21	93	33	51	14	104	34	15	0	—	—	

PLACE—RANGOON. OBS. △ LAT. 16° 46′ N., LONG. 96° 12′ E.

METEOROLOGICAL TABLE COMPILED AT THE METEOROLOGICAL OFFICE.

MONTH.	BAROMETER, reduced to 32° and Sea Level.		TEMPERATURE.				Relative Humidity.	Clouds, 0 to 10. Mean Amount.	RAIN.		WIND.										No. of Days Gales.	No. of Days Fogs.	REMARKS.
	Mean Height.	Extreme Range.	Mean.	Mean Daily Range	Max.	Min.			Total Fall.	No. of Days.	Average Hourly Velocity.	Number of Days from											
												N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm			
	22 Yrs.		20 Yrs.	14 Years.			21 Yrs.	21 Yrs.	27 Yrs.	13 Yrs.	11 Yrs.	13 Years.											
	Ins.	Ins.	°	°	°	°			Ins.		Miles.												
January	29·98	Not obtainable.	74·0	24	97·7	55·3	64	2	0·12	1	4	7	9	2	2	1	2	3	3	2	Not obtainable.	Not obtainable.	
February	29·95		76·4	27	99·9	55·7	63	2	0·27	1	4	3	4	2	3	4	5	3	3	1			
March	29·90		80·5	26	104·3	62·0	64	2	0·18	1	5	1	1	2	5	7	10	3	1	1			
April	29·84		84·7	22	106·4	70·4	66	3	1·82	3	6	1	1	1	4	7	10	4	1	1			
May	29·80		82·5	15	106·7	71·8	78	7	10·79	15	5	1	1	2	4	8	9	4	1	1			
June	29·78		79·4	9	97·8	72·9	89	9	18·62	27	5	0	1	1	4	11	10	2	0	1			
July	29·77		78·3	9	93·1	72·4	90	9	21·60	29	5	0	0	1	2	9	14	3	1	1			
August	29·79		78·5	9	90·8	72·6	90	9	18·68	27	5	1	1	1	2	6	13	4	1	2			
September	29·82		78·7	10	91·8	72·4	89	8	16·13	24	4	1	1	2	3	7	10	2	1	3			
October	29·89		79·8	12	92·8	70·2	84	6	7·28	14	3	2	5	4	5	6	4	1	1	3			
November	29·94		77·9	14	94·0	60·8	78	4	2·76	5	4	4	12	5	3	1	1	1	1	2			
December	29·98		75·4	19	95·4	59·5	72	3	0·07	1	5	9	12	4	2	1	1	0	1	1			
Means and Totals	29·87	—	78·8	16	106·7	55·3	77	5	98·32	148	5	30	48	27	39	68	89	30	15	19	—	—	

PLACE—MOULMEIN. OBS. △ LAT. 16° 29′ N., LONG. 97° 40′ E.

METEOROLOGICAL TABLE COMPILED AT THE METEOROLOGICAL OFFICE.

MONTH.	BAROMETER, reduced to 32° and Sea Level.		TEMPERATURE.				Relative Humidity.	Clouds, 0 to 10, Mean Amount.	RAIN.		WIND.										No. of Days Gales.	No. of Days Fogs.	REMARKS.
	Mean Height.	Extreme Range.	Mean.	Mean Daily Range	Max.	Min.			Total Fall.	No. of Days.	Average Hourly Velocity.	Number of Days from											
												N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm			
	13 Yrs.		13 Years.				10 Yrs.	9 Yrs.	47 Yrs.	13 Yrs.	9 Yrs.	10 Years.											
	Ins.	Ins.	°	°	°	°			Ins.		Miles.												
January	29·98	Not obtainable.	75·1	24	95·1	54·8	64	1	0·18	1	2	7	8	4	3	0	1	2	6	0	Not obtainable.	Not obtainable.	
February	29·94		77·3	25	97·9	56·0	63	1	0·14	1	2	2	6	5	2	0	4	5	4	0			
March	29·91		81·2	22	100·5	61·9	66	1	0·25	1	3	1	2	3	2	2	12	8	1	0			
April	29·85		83·0	19	100·9	69·0	69	2	3·24	6	3	1	1	1	1	3	14	7	2	0			
May	29·80		81·4	15	101·5	69·4	77	5	20·05	19	3	1	2	1	3	5	11	6	2	0			
June	29·79		77·9	10	92·9	70·8	89	8	38·05	28	3	0	1	1	4	9	12	2	1	0			
July	29·78		76·9	9	90·5	70·6	90	8	44·88	29	4	0	1	1	2	9	13	4	1	0			
August	29·80		77·1	9	98·4	69·7	90	8	42·15	28	3	0	1	1	2	8	14	3	2	0			
September	29·82		77·7	10	91·5	70·6	88	6	30·13	26	3	1	2	2	3	4	12	4	2	0			
October	29·87		79·9	13	95·6	67·5	81	3	8·17	14	2	3	6	5	4	2	5	3	3	0			
November	29·91		78·4	16	99·4	59·1	74	2	1·44	4	2	6	7	6	5	1	1	1	3	0			
December	29·96		75·6	20	93·2	56·2	62	1	0·02	1	3	9	7	5	5	1	1	0	3	0			
Means and Totals	29·87	—	78·5	16	101·5	54·8	76	4	188·70	158	3	31	44	35	36	44	100	45	30	0	—	—	

PLACE—MERGUI. OBS. △ LAT. 12° 11′ N., LONG. 98° 38′ E.

METEOROLOGICAL TABLE COMPILED AT THE METEOROLOGICAL OFFICE.

MONTH.	BAROMETER, reduced to 32° and Sea Level.		TEMPERATURE.				Relative Humidity.	Clouds, 0 to 10, Mean Amount.	RAIN.		WIND.										No. of Days Gales.	No. of Days Fogs.	REMARKS.
	Mean Height.	Ex-treme Range.	Mean.	Mean Daily Range	Max.	Min.			Total Fall.	No. of Days.	Average Hourly Velocity.	Number of Days from											
												N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm			
	16 Yrs.		14 Yrs.	13 Years.			14 Yrs.	13 Yrs.	33 Yrs.	12 Yrs.	10 Yrs.	13 Years.											
	Ins.	Ins.	°	°	°	°			Ins.		Miles.												
January	29·95	Not obtainable.	76·8	21	93·8	55·4	74	3	0·75	2	2	7	6	2	1	0	1	2	12	0	Not obtainable.	Not obtainable.	
February	29·95		79·2	20	96·6	60·9	76	3	1·72	3	2	4	2	2	2	0	1	3	14	0			
March	29·92		81·0	19	98·8	66·4	77	4	2·62	6	2	4	2	2	3	1	2	3	14	0			
April	29·87		81·7	18	97·6	69·4	79	5	6·03	7	2	4	1	2	2	1	2	5	13	0			
May	29·85		80·5	16	98·8	70·5	83	8	18·08	18	2	2	1	2	3	4	6	5	8	0			
June	29·84		77·8	12	96·8	67·4	89	9	30·50	26	2	1	0	1	2	5	12	5	3	1			
July	29·85		77·2	12	96·8	66·4	89	9	31·18	27	2	1	1	0	1	4	12	6	5	1			
August	29·85		77·4	12	92·3	67·0	89	9	29·32	26	2	1	1	0	1	4	12	7	5	0			
September	29·87		77·3	12	92·3	68·4	89	9	26·84	24	2	2	0	0	2	3	10	7	6	0			
October	29·89		78·3	15	92·3	64·5	85	7	13·00	19	2	3	2	3	3	3	6	4	6	1			
November	29·91		77·8	17	94·1	58·9	80	5	3·21	8	2	6	8	5	2	1	2	1	5	0			
December	29·94		76·7	20	92·6	55·4	74	3	0·46	2	2	8	11	5	1	0	1	0	5	0			
Means and Totals	29·89	—	78·5	16	98·8	55·4	82	6	163·71	168	2	43	35	24	23	26	67	48	96	3	—	—	

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